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TEACHER'S CORNER: LICHENS FOR THE CLASSROOM

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Often inconspicuous and overlooked by the unattentive eye, lichens reveal certain fundamental ecological principles. Remaining relatively unchanged through the seasons, lichens can illustrate aspects of the natural world at seasons when other plants are dormant or otherwise unattainable.

Appearing as one plant, lichens are an example of symbiosis. Here, two plant species, an alga and a fungus, are living together with each assisting in the survival of the other. The algal component is similar to those found in lakes and ponds. Sugar products made by the alga through photosynthesis are utilized by the fungus. In turn, the fungus provides a suitable environment for the alga, by forming the bulk of the lichen body. The alga largely determines the colours of the different species. The resulting thallus has no similarity to either component.

This fascinating relationship occurs in most regions throughout the world from the High Arctic to the Taiga- : on trees, ground, rock, and other suitable substrates.

Often confused with mosses, which have primitive leaves and stems, lichens lack these morphological characteristics. Instead, they have three major growth forms:

a) crustose - crust-like, often adhering to the substrate.

b) fruticose - simple to multi-branched; round to oval in cross section; growing erect or hanging from the substrate on which they are attached or growing free.

c) foliose - leaf-like, having distinct upper and lower surfaces which are flat in cross-section.

Lichens range in colour from bright orange to ash grey to brown, with numerous intermediate shades. Their size is also variable. Some are barely conspicuous between the cracks in bark or rock while others, such as *Usnea* spp. hang for up to a metre or more in length.

Lichens benefit the environment by contributing to the formation of soil,

directing nutrients to the substrate for plant uptake and providing forage for certain wildlife (e.g. Woodland Caribou in northern Canada). More recently, they have provided environmentalists with a measure of excessive air pollution.

For the teacher, lichens can serve to illustrate major environmental topics such as species differentiation, environmental requirements and competition. The following may serve as a possible framework for a lichen study in the curriculum.

After an introduction concerning this diverse group of plants, the instructor should guide students around the schoolyard and surrounding neighbourhood, pointing out the many different colours and growth forms which distinguish the different species of lichens and separate them from other members of the Plant Kingdom. Cut off a small piece of thallus and observe the overall shape, and outer fungal and inner algal layers. Have students establish small square plots (approximately 30 x 30 cm) on a variety of terrain surfaces. Divide students into groups, with each assigned one of the plots. The students should then determine the number of species in each plot by distinguishing the various colours and growth forms. In this exercise letters or numbers may be used to represent the name of a species. For each species a record should be kept as to its growth form (ie., crustose, fructose, foliose), colour, and its relationship to other lichens and plant species in the particular plot. After observations have been completed, have the groups meet to compare information on the occurrence of lichens under different environmental conditions.

As a long term project teachers may elect to have students establish permanent lichen monitoring stations in localities throughout an urban center. The stations should be approximately 30 x 30 sq. cm. and distributed on various terrain surfaces. Stations should be described thoroughly and species mapped to serve as baseline information from which comparisons with later years may be made.

Many benefits would result from including lichens in a curriculum. This would increase the students' awareness of the natural world and facilitate instruction of such important ecological principles as symbiosis, competition, niche, habitat requirements and species diversity. It would also allow participation at both individual and group levels. Lichens are a major component of our natural world, and their study makes a valuable addition to a curriculum planned for any age.

HIGHLIGHTS OF SPRING BIRD MIGRATION FOR SOUTHERN ALBERTA, 1979

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by Rudi Butot
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Spring arrived on the southern prairies early in March with above normal temperatures, which lasted for about three weeks. A mighty dust storm swept past Calgary on 24 March, ahead of an advancing cold front that brought fresh snow and unseasonal temperatures; these were to last until the last week in May. The spring migration which was just getting under way in mid-March was effectively shut down, but the long unseasonal spell also kept lakes frozen in central and northern Alberta until the third week in May. This in turn caused several species not usually found in large numbers in southern Alberta to linger.

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As many as eight Common Loons were reported from the Bow River in Calgary late in April, and five were sighted near Carseland. Large numbers of Red-breasted and Common mergansers were also seen during those days near Carseland and Chestermere Lake, while nine Ring-necked Ducks were seen near Priddis on 21 April, and 63 were reported from near Bottrel on 8 May. Three Oldsquaw were reported from near Didsbury on 12 May, and two Surf Scoters a day later from Ardenode. A sighting of the rare European Wigeon was received from Shepard on 15 April. Three pairs of Cinnamon Teal on 29 April at Calgary were the first for 1979.

An early Red-tailed Hawk was seen near Morley on 3 March, while the first Ferruginous Hawk sightings were made near Conrich and Carseland on 22 April, both of single birds. Broad-winged Hawks were seen near Ensign on 7 May and Bottrel on 20 May. Both the Bald Eagle migration in March and the Rough-legged Hawk migration in April were substantial through our area. A single Osprey was reported from Calgary on both 21 and 28 April. Prairie Falcon sightings, usually single birds, came from many areas during March and April.

White-rumped Sandpipers were seen on three occasions, one at Cheadle on 13 May, two at Sounding Lake on 20 May, and one near Conrich on 26 May. A banded Semi-palmated Sandpiper, believed to have been banded in Surinam, was seen near Coronation on 20 May, in company with about 300 of its own kind and over 2500 Northern Phalaropes. Pectoral Sandpipers were rather common during May, while small flocks of Short-billed Dowitchers were reported from the Beaverhill Lake area, and Cadogen, during the third week of May. Good concentrations of Stilt Sandpipers were seen in the eastern part of Alberta, near Kirriemuir, at the same time. The largest flock of some 85 birds was seen near Altario on 20 May, while 32 were seen near Irricana the following day.

Northern Shrikes were quite numerous in our area during their northward migration in the first two weeks of April. A larger than usual number of Townsend's Solitaires was reported from our area during the third week of April. A rare Black-throated Blue Warbler male was seen in Calgary on 1 June. Two male Bobolink sightings were reported, one from near Bottrel on 23 May and one near Didsbury on 26 May. A single Swamp Sparrow was reported from Calgary on 11 May, as was a Brewer's Sparrow one day later.

Additional data for this period can be found in the spring and summer issues of The Calgary Field Naturalist.

SMALL MAMMALS TRAPPED IN THE FORT MCKAY AREA, 1977

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by Wayne W. Smith
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During the mid-fall of 1977 I carried out some trapping for small mammals about 40 miles north of Ft. McMurray. The study area was centered about the junction of the Muskeg River and Hartley Creek, about 10 miles north-east of Ft. McKay. The general landscape is one of extensive muskeg with scattered jack -pine (*Pinus banksiana*) ridges and aspen-covered uplands.

A total of 25 traps were set up between 30 August and 9 September. Trapping ceased between 24 and 25 September, after a total of 526 trap nights. Traps were of the pitfall type (cans sunk into the ground with the tops flush with the ground

surface). Traps were set up in four locations: 1) The Pit, 2) Interface Plot, 3) Kearl Lake, and 4) Hartley Creek. The 12 traps at the Pit were set in three basic habitats: 1) willow-sedge along the edge of the Muskeg River, 2) black spruce-moss-shrub covered muskeg, and 3) dry aspen-willow-rose covered uplands. The four traps at the Interface Plot were set in either: 1) dry aspen-rose -cranberry covered uplands, or 2) black spruce-willow-moss covered muskeg. The five traps at Kearl Lake were set in damp aspen woods with a dense cover of forbs and litter close to the edge of Kearl Lake. The four traps set at Hartley Creek were all on the willow-alder covered edge of Hartley Creek.

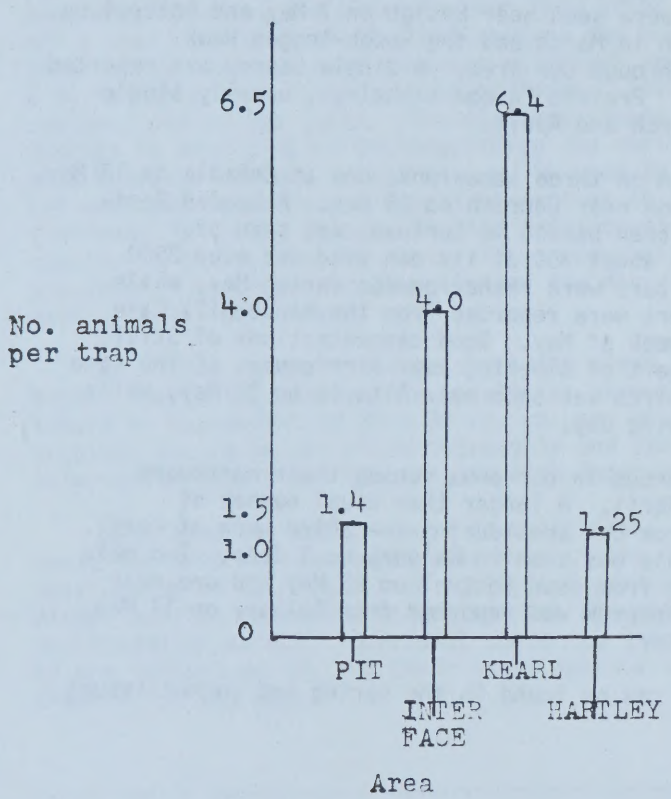

Figure 1.
Number of animals caught per trap in the 4 areas

A total of 70 animals were trapped, or 2.8 animals per trap. Catch per unit effort works out to 0.133 animals per trap night, or 1 animal per 15.03 trap nights.

The 70 animals trapped represent eight species. In decreasing order they were:

Masked Shrew (*Sorex cinereus*) - 28 specimens

Boreal Red-backed Vole (*Clethrionomys gapperi*) - 21 specimens

Meadow Vole (*Microtus pennsylvanicus*) - 6 specimens

Meadow Jumping Mouse (*Zapus hudsonius*) - 5 specimens
Arctic Shrew (*Sorex arcticus*) - 4 specimens
Pygmy Shrew (*Microsorex hoyi*) - 3 specimens
Short-tailed Weasel (*Mustela erminea*) - 2 specimens
Northern Bog Lemming (*Synaptomys borealis*) - 1 specimen

Of the 4 trapping areas, Kearl Lake proved to be the most productive (Figure 1).

Figures 2, 3, and 4 show the number of animals trapped per 24 hour day.

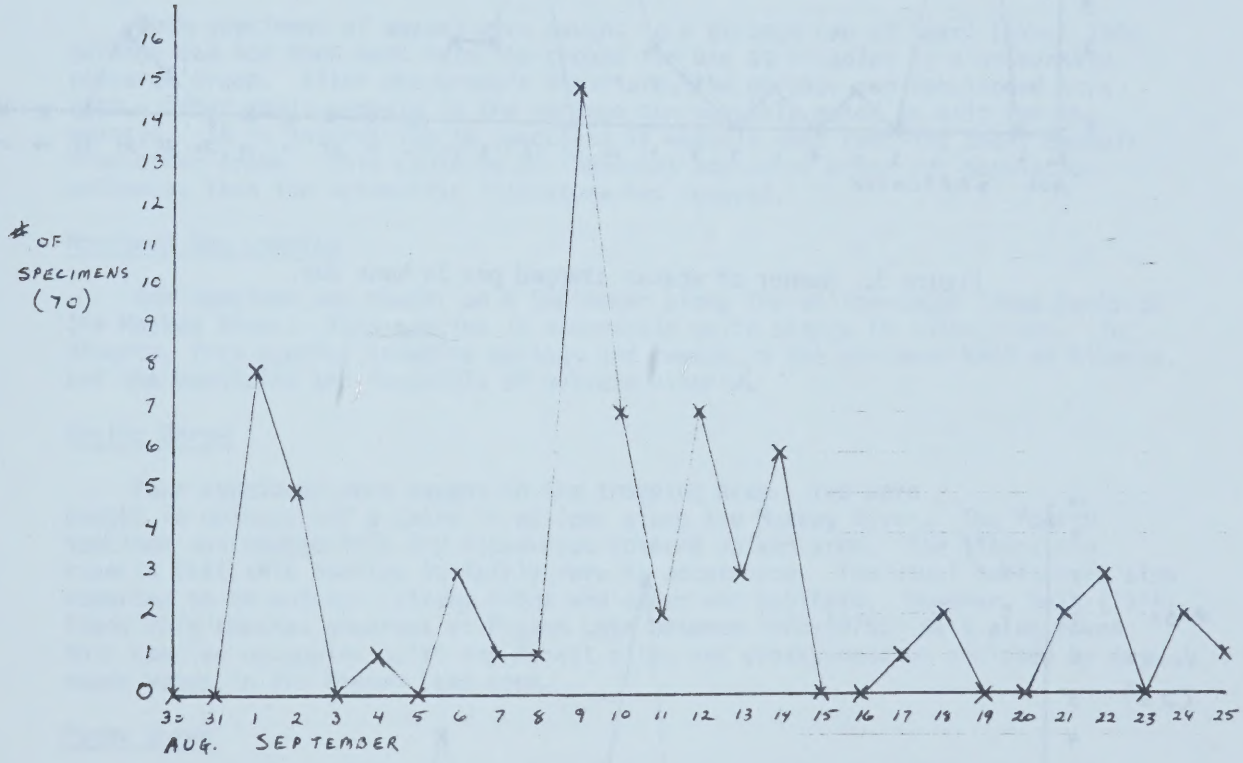

Figure 2. Number of specimens trapped per 24 hour day.

The figures indicate four peaks: 1) 1 September, 2) 9-10 September, 3) 12 September, and 4) 14 September. The peak on 1 September occurs because the majority of the traps at The Pit and at Interface Plot were set up the day before. The peak on 9-10 September is of animals trapped mainly at Kearl Lake. Traps at Kearl Lake were set up on the 8 and 9 September. The peaks on 12 and 14 September are also of animals mainly from Kearl Lake. Apparently, most animals are trapped from a given area within 1-4 days of the traps becoming operational.

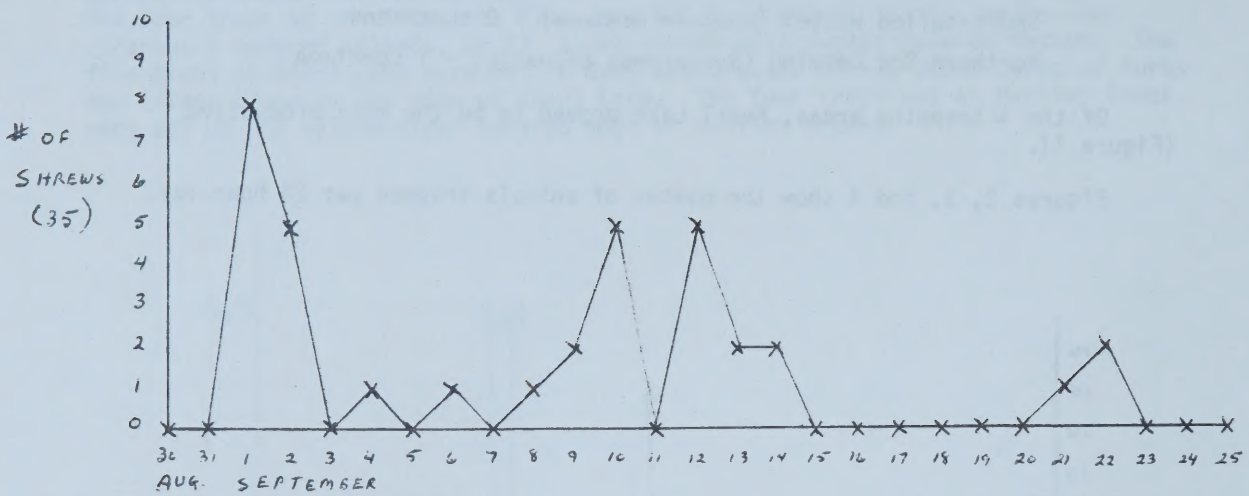

Figure 3. Number of shrews trapped per 24 hour day.

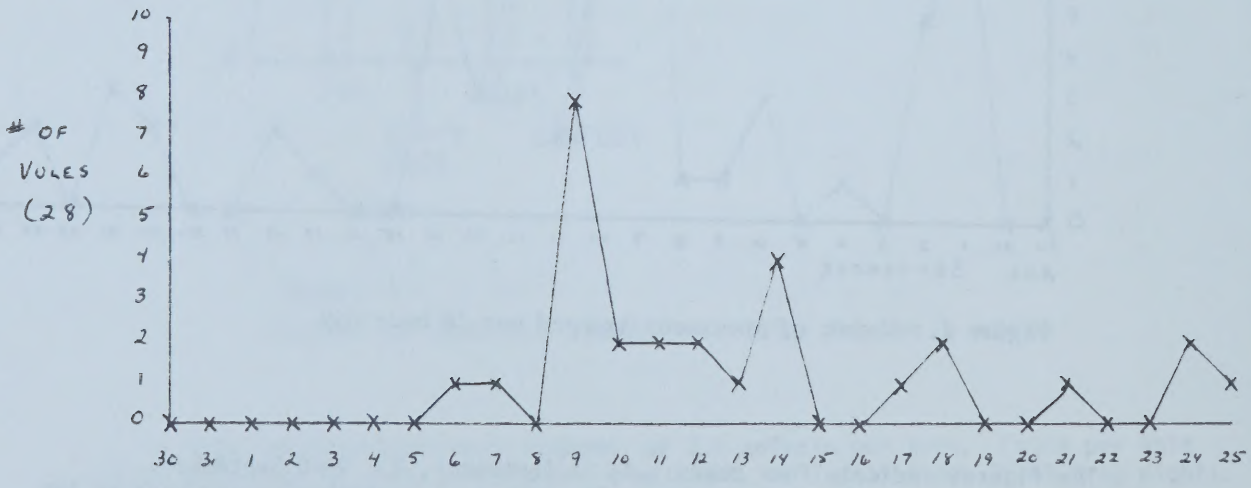

Figure 4. Number of voles trapped per 24 hour day.

Most traps caught between one and two animals, while four traps caught nothing. One trap caught 15 animals. This trap was unusual in that it was a large, metal garbage can that caught the only two Short-tailed Weasels, four of the five Meadow Jumping Mice and 6 of the 21 Boreal Red-backed Voles. Eight of the 25 traps caught more than one animal in a 24 hour period. With two exceptions, these traps caught two, three or four animals in one 24 hour period. One trap at the Interface Plot caught seven animals in one 24 hour period, while the garbage can at Kearl Lake caught 12 animals in one 24 hour period. However, the Kearl Lake garbage can had been trapping animals for as long as a week before it was discovered.

Some comments on four of the species trapped follow:

Short-tailed Weasel

Both specimens of weasel were caught in a garbage can at Kearl Lake. This garbage can had been sunk into the ground for use as a cooler by a university research group. After the group's departure, the garbage can functioned as a trap. Other small mammals in the garbage can possibly acted as bait for the weasels. It is interesting to speculate if weasels were removing small mammals from other traps. This could be an important source of error for population estimates that the scientific literature has ignored.

Northern Bog Lemming

One specimen was caught on 6 September along the willow-sedge lined banks of the Muskeg River. This species is apparently quite scarce in collections. In Alberta, this species inhabits muskegs and swamps in the northern half of Alberta, and the mountains and foothills of western Alberta.

Arctic Shrew

Four specimens were caught in the trapping area. Two were caught in muskegs and a third in willows along the Muskeg River. The fourth specimen was caught in a dry aspen-rose covered upland area. The literature reports that this species is fairly rare in occurrence. The usual habitat is also reported to be muskegs, stream sides and other wet habitats. However, Salt (1974) found this species numerous at Pigeon Lake between 1972-1975. Salt also found this species occupying quite dry forest sites and grassy meadows enclosed by dry aspen woods in the Pigeon Lake area.

Pygmy Shrew

Three specimens were caught in a trap at Kearl Lake within 72 hours of the traps becoming operational. One was trapped with two Masked Shrews and one Boreal Red-backed Vole on 10 September. The same trap produced two Pygmy Shrews on 12 September. The habitat around the trap was damp aspen woods with an abundance of forbs and litter close to the edge of Kearl Lake. This shrew is generally considered to be extremely rare and to occur only in quite dry upland situations. However, Pygmy Shrews have been shown to inhabit quite moist situations (eg. Long 1972; Spencer and Pettus 1966). Also, Pygmy Shrews have been trapped in "comparatively" large numbers in a few localities. Part of this "increased" abundance may very well be due to trapping techniques. The pitfall trap is more accurate in censusing shrew populations than the traditional box live-trap or snap -traps (eg. MacLeaod and Lethiecq 1963; Brown 1967).

My appreciation is given to Jim Salt for species identification. Specimens are deposited in the Provincial Museum and Archives.

LITERATURE CITED AND OTHER SELECTED REFERENCES

Banfield, A.W.F. 1974. The mammals of Canada. Univ. Toronto Press, Toronto.

Brown, L.N. 1967. Ecological distribution of six species of shrews and comparison of sampling methods in the central Rocky Mountains. Journ. Mammal. 48:617-623.

Buckner, C.H. 1966. Populations and ecological relationships of shrews in Tamarack bogs of southeastern Manitoba. Journ. Mammal. 47:181-194.

Burt, W.H. and R.P. Grossenheider. 1976. A field guide to the mammals. Houghton Mifflin Co., Boston.

Long, C.A. 1972. Notes on habitat preference and reproduction in Pygmy Shrews, *Microsorex*. Can. Field-Nat. 86:155-160.

MacLeod, C.F. and J.L. Lethiecq. 1963. A comparison of two trapping procedures for *Sorex cinereus*. Journ. Mammal. 44:277-278.

Pearson, O.P. 1950. Keeping shrews in captivity. Journ. Mammal. 31:351-352.

Rudd, R.L. 1953. Notes on maintenance and behavior of shrews in captivity. Journ. Mammal. 34:118-120.

Salt, J.R. 1974. The Soricidae of Alberta, a review. Provincial Museum and Archives of Alberta, Edmonton. unpubl. ms.

Smith, W.W. 1974. Some aspects of North American shrew ecology. unpubl. ms.

Soper, J.D. 1964. The mammals of Alberta. Hamly Press, Edmonton.

Spencer, A.W. and D. Pettus. 1966. Habitat preferences of five sympatric species of Long-tailed Shrews. Ecology 47:677-683.

PRE-MATING BEHAVIOUR OF THE PRAIRIE RATTLESNAKE (CROTALUS VIRIDIS VIRIDIS) IN SOUTHEASTERN ALBERTA

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A well known but little understood resident of the western grasslands is the Prairie Rattlesnake (*Crotalus viridis viridis*). Reaching the northern limits of its range in southeastern Alberta and southwestern Saskatchewan, the Prairie Rattler is restricted primarily to river valleys and badlands where human disturbance is minimized (Lewin, 1963; Pendlebury, 1977; Stebbins, 1966). Although the importance of this predator in maintaining ecological stability of an area is well known, suitable habitat for the rattlesnake continues to decline on the Canadian prairies.

The mating behaviour of the Prairie Rattlesnake in Alberta is rarely observed and poorly documented. The majority of studies occur in the more southern part of its range and these pertain mainly to reproductive cycles with no description of the pre-mating behaviour (Rahn, 1942; Wood, 1933). During the summer of 1976 I

spent approximately five months living on the grasslands near the Milk River, southeastern Alberta, during which time I made observations over a one week period of the pre-mating behaviour of this snake.

In mid-July evidence of pre-mating was obtained along a south-facing coulee slope. Two snakes (presumably male and female) were observed in close contact interwoven about each other. One, slightly smaller both in width and length, was thought to be the female. She was greenish-yellow in colour, much lighter than her brownish-green mate. The "female" kept her head in a hole during the entire pre-mating process.

The large ("male") snake continued to caress the "female" with his head as his body wove around and along hers. This process continued during the warmest hours of the day. When disturbed the "male" snake separated from the "female" and moved rapidly along the coulee face for about 10 metres, then disappeared into a hole. When the "male" separated from her, the "female" immediately went down the hole in which she had kept her head.

The entire pre-mating period which lasted for about one week ended as rapidly as it had begun with no evidence of the two snakes re-entering the area. Although other areas were scanned for evidence of this behaviour, none was observed. The predictable regularity of the process over a week period in addition to its close similarity with pre-mating behaviour observed for other snakes makes it seem likely that this process is closely linked with mating of the Prairie Rattlesnake.

LITERATURE CITED

Lewin, V. 1963. The herpetofauna of southeastern Alberta. Can. Field-Nat. 77:203-214.

Pendlebury, G.B. 1977. Distribution and abundance of the Prairie Rattlesnake, *Crotalus viridus viridus*, in Canada. Can. Field-Nat. 91:122-129.

Rahn, H. 1942. The reproductive cycle of the Prairie Rattler. Copeia 1942:233-240.

Stebbins, R.C. 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston. 279 pp.

Wood, F.D. 1933. Mating of the Prairie Rattlesnake, *Crotalus confluentus confluentus*, Say. Copeia 1933:84-87.

THE WOOLY LIP-FERN (CHEILANTHES FEEI MOORE) IN ALBERTA

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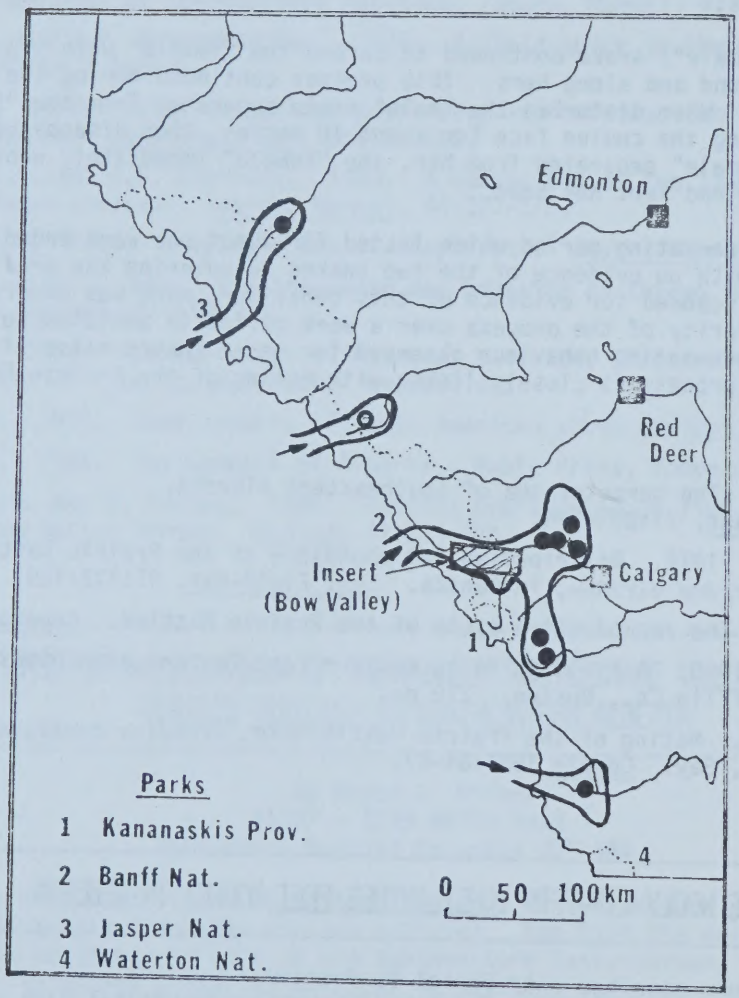
This rock fern was considered to be so rare in the province that in the Flora of Alberta it was not even included in the key to ferns. At that time it was only "...known from dry rock crevices, near Banff" (Moss 1959). Subsequent investigations have shown that it is not only local but also widespread in the mountains of western Alberta (Fig. 1), and that it is abundant in the Bow Valley (Fig. 2). In fact, it is the common fern in the Bow Valley, and at such locations as Exshaw and Tunnel Mountain (Banff National Park) it occurs in millions.

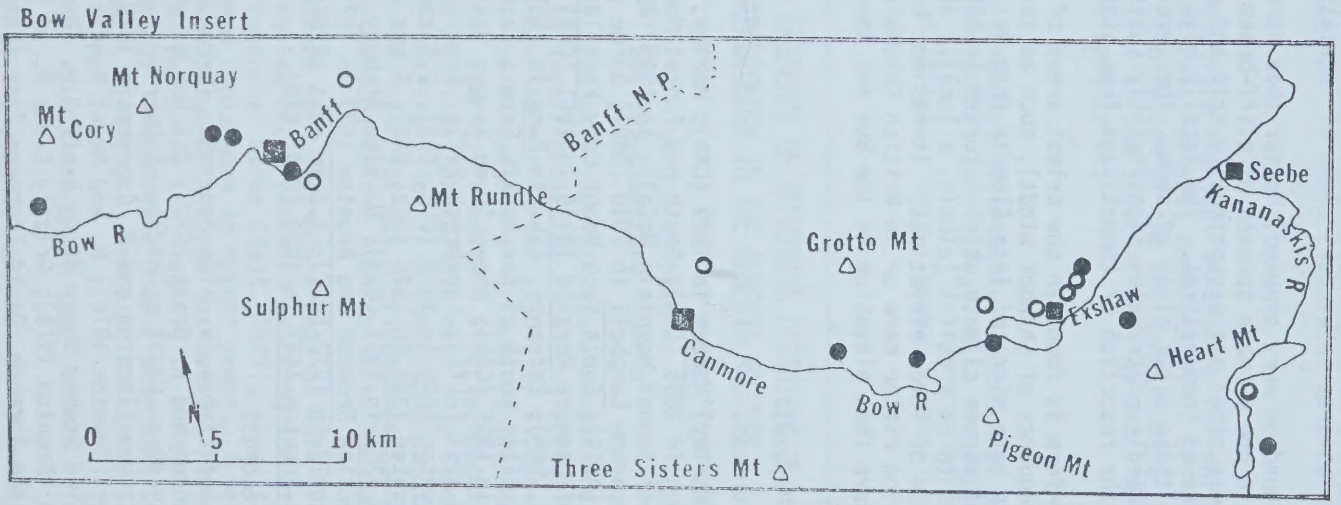
Figure 1: Distribution of Cheilanthes feei in Alberta (excepting the Bow Valley)



● - Specimen Record

O - Sight Record

gure 2: Distribution of Cheilanthes feei in the Bow Valley



● - Specimen Record

○ - Sight Record

The Woolly Lip-fern is a diminutive plant, with short, curled fronds which grow in dense "pin-cushions" out from ledges and crevices in limestone and other calcareous cliffs and rock-faces. As it's name suggests, the plant is densely covered in woolly hairs along the stipe and fronds. This is probably a water preservation characteristic. The over-all appearance is of a fuzzy, dense, greyish-green (brownish-grey in winter) clump of vegetation plastered to the rock.

This fern is found on very exposed, hotter than normal, south-west-facing rock exposures, often with one or more species of cliff-brake ferns (*Pellaea* spp.) (Brunton 1979). These sites are exceptionally arid and even in winter, maintain surprisingly high ground temperatures. The locally high temperature, combined with chinook winds, keep these sites clear of snow. The severe degree of exposure which results undoubtedly contributes significantly (with the already demanding site condition) to the reduction of competition from other vegetation.

The Woolly Lip-fern is found in the driest areas of the mountains, (which have the highest frequency of Chinook winds), such as the Bow Valley, and Crowsnest Pass. It appears to have migrated into Alberta from British Columbia, perhaps during the period of warmer climate which occurred in Alberta *ca.* 4,000 - 5,000 years ago. It seems to be a relict (albeit, a locally abundant one) of that warmer climate and a species of lower elevations. It has not been found above 5,200 feet (1,750 m) in elevation either here or in British Columbia. Extensive searches of suitable habitat above that elevation in the Bow and Kananaskis valleys have been unsuccessful.

Records Cited (and Mapped):

Specimens: (19 records)*

Old Bow Fort [Morley] Macoun in 1879 (CAN); Morley, Foothills of Rocky Mountains Macoun in 1885 (CAN); South end Tunnel Mountain Smith in 1889 (CAN); cliffs of Tunnel Mountain McCalla in 1899 (ALTA); Banff Anderson in 1899 (DAO); Cochrane Campbell in 1940 (DAO); Gorge west of Exshaw McCalla 11530 in 1951 (ALTA); South face Mount Cory Porsild 17992 in 1951 (CAN); 4 miles east of Canmore Porsild 18146 in 1951 (CAN), Brunton 1291 in 1976 (CAN, DFB, DAO); Entrance, Alberta Pegg in 1955 (DAO), Peg 2096 in 1965 (ALTA); 5 miles south of Kananaskis Forest Experiment Station Porsild and Lid 19423 in 1956 (CAN); Above Sheep Ranger Station, Gorge Creek Carefoot 43 in 1961 (ALTA); Lundbreck Falls, Crowsnest Pass Lafontaine in 1973 (DFB), Brunton 1608 in 1978 (DFB, CAN); 2.5 kms N.E. of Exshaw Brunton and Brunton 1248 in 1976 (DFB, DAO); 4 kms west of Exshaw Brunton and Strickland 1362 in 1977 (DFB); N. side Highway 1A, 1.8 kms west of Morley intersection Brunton and Brunton 1523 in 1977 (DFB): Wildcat Hills [Collector?] in 1977 (UAC); 1.3 km east of Highwood Ranger Station, Highwood River Brunton 1617 in 1978 (DFB, CAN).

Sight Records (11 records)

1.5 miles S.E. of Exshaw, W. side Heart Mt. (Brunton 1977); 2 kms N.E. of Exshaw (Brunton and K. Grant 1977); 2.5 kms W. of Exshaw (Brunton 1978); W. side Highway 40 on knoll at middle of Barrier Lake (Brunton 1978); 1 km N.E. of Exshaw (Brunton and H. Coneybeare 1978); S.W. side Lac des Arc, Bow Valley (Brunton 1976); N. end Mount Rundle (Brunton and H. Dickson 1978); South side Stoney Squaw Mtn., Banff N.P. (Brunton 1978); N. side Banff Airfield (Brunton 1978); Grizzly Creek N. of Canmore (Brunton *et al* 1978); W. of Lake Abraham, David Thompson Pass (Coneybeare 1978).

*Herbarium Acronyms: CAN - National Museum of Canada, Ottawa; DAO - Biosystematics Research Institute, Ottawa; ALTA - University of Alberta, Edmonton; UAC -

University of Calgary, Calgary; DFB - Herbarium of D.F. Brunton, Canmore.

Undoubtedly, additional stations will be found; new records from the Athabaska River Valley, The Crowsnest and David Thompson Passes and the foothills east of the Bow Valley will be particularly valuable in filling in gaps in the known range of this species.

Acknowledgements

My thanks to H.F. Coneybeare and J.D. Lafontaine for notice of the David Thompson Pass and Crowsnest Pass records, respectively. Dr. C.D. Bird and B. Hallworth facilitated examination of the UAC Herbarium, as did J. Packer and M. Dumais at ALTA, J. Gillett at CAN and W.J. Cody at DAO. My thanks, too, to W. Wackerle for typing the manuscript.

LITERATURE CITED

Brunton, D.F. 1979. The taxonomy, distribution and ecology of the Cliff-brake ferns (*PELLAEA*: POLYPODIACEAE) in Alberta. Can. Field-Nat. 93:288-295.

Moss. E.H. 1959. Flora of Alberta. Univ. Toronto Press, Toronto.

SOME ELEMENTS OF AMPHIBIAN DISTRIBUTION AND BIOLOGY IN THE ALBERTA ROCKIES

---

by Jim R. Salt
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There is surprisingly little in the literature concerning the herptiles of the Alberta Rockies, and an investigation of local collections shows that the only extensive recent work was carried out in the 1950's by Lister and Moore, whose specimens are deposited in the University of Alberta Zoology Museum. Even some of the more thorough biological studies in western Alberta appear either to have ignored the amphibians and reptiles, or to have made only superficial species -lists. While the present notes are far from comprehensive, they will under the circumstances include some new material not previously published on amphibian distribution, breeding and ecology in the Alberta Rocky Mountains.

The information assembled here includes a body of data from the Kananaskis region, gathered in part during field research by Peregrine Research & Documentation Ltd., for Provincial Parks (Salt, 1977), as well as many records from the company's own non-funded field work in recent years. I am indebted to Resource Assessment and Management division of Alberta Recreation, Parks & Wildlife for permission to draw upon the Peregrine Ltd. report. I am also grateful to the following for their assistance in the field and/or with their own records: V. Aziz, V. Lewin, N. Panter, C. Roth, W. Roberts, C. Tebby, C. Wallis, A. Wiseley.

ROCKY MOUNTAIN AQUATIC ENVIRONMENTS

A general description of the aquatic marginal environments of the upper Kananaskis has already been given (Salt and Clark, 1979), but this is both too confined geographically and too general as habitat description for the purposes of a discussion of amphibians. Yet a detailed analysis of aquatic environments would

require volumes of description and comparison. A brief and admittedly very generalized classification of Rocky Mountain aquatic sites is given here; some specific notes are included in the species discussions below, as required.

The aquatic environments of the Alberta Rockies may, for our purposes, be divided into three general categories. The first of these is the deep, constantly refreshing lakes or ponds and the perennial or seasonal streams and rivers. Lakes such as Louise, Moraine, Bow, Maligne, Brazeau, Amethyst, Kananaskis, with dozens of lesser high-elevation ponds, and most of the creeks and rivers, are of this type. It will be appreciated that some of these may have very minor marginal or backwater areas of warm shallow calm waters attached to them, which resemble the second type discussed below. In the main however, there is little or no bottom vegetation; the beds are essentially gravels, bedrock or boulder with varying depths of sediments. The lakes are often very deep. The streams and rivers are swift or with strong currents, and many are scarified frequently by ice floes. The water levels vary greatly over short periods or seasonally, and the rivers are seasonally laden with sediments. The water temperatures in them are rarely higher than 5^{o} to 70^{o}C, with an average between 3^{o} and 5^{o}C. The significance of these features to the amphibian fauna is somewhat limited, but some may serve as travel routes, and a few are used either annually or periodically for over-wintering.

The second aquatic "type" consists of water entrapments in the form of shallow ponds or sloughs, bog or fen pools, and backwaters. All of these features have still or stagnant water, rich in algal and invertebrate life. The shallow bog lakes are quite often alkaline, and have margins including both evaporation plains (seasonal mud flats) and deep mosses - in which *Sphagnum* is a significant component at more northerly locations. There is also a variety of sedges, rushes and grasses, insectivorous plants (sundew, *Drosera*; butterwort, *Pinguicula*), and orchids (*Orchis, Habenaria*) in the margins. Backwaters and floodpools may resemble sloughs, with cattail (*Typha*) but with a less diverse secondary flora. There are as well a number of aquatic "erratics" which can be classed with this group; such seasonal, temporary or artificial environments as the standing water in ditches and on old disused roads, in borrow pits or gravel pits, in some deep ungulate dust-wallows and in long-abandoned beaver sites. All of these may be vital to some populations of breeding amphibians in the region.

Water temperatures in these situations vary much more widely and rapidly than do those of the cold water lakes and streams. Winter temperatures of the shallow ponds are from 0 to 3^{o}C beneath ice; but summer temperatures often rise above 20^{o}C. The fluctuation in shallow waters at mid-summer may be as much as 8^{o} to 12^{o}C in a twenty-four hour period, and it would be difficult to ascertain the average, in waters so responsive to ambient air temperature and sunshine. But in their margins these features seldom drop below 11^{o}C through the summer and autumn (late May to late September) and they become warm very rapidly early in the year.

Examples of these features are to be found periodically at lower and middle elevations from such localities as Leach, Honeymoon and Edith Lake groups in Jasper, south along the major valleys to Vermilion Lakes and the Chilver Lake group in Banff and Bow Valley Provincial Park, to unnamed ponds in Kananaskis and the Crowsnest. In the more southerly part of the range, these aquatic features occur to an elevation of over 1875 m; in the north (Jasper) they are found to about 1450 m, but above 1400 m they are extremely limited in their flora and fauna. Very localized examples may be found at higher elevations, of course, but lacking both the temperature stability and other qualities necessary to amphibian reproduction.

A third, less-easily defined aquatic environment is that of the slow-running and well-vegetated brook or rill, the seep or spring area, and other confined, slow-moving waters. The flora at these varies greatly, but the temperature range is somewhat higher than that of the major streams and creeks (7^{o} to 90^{o}C). These features are in some regions a favourite habitat for such species as the Spotted Frog.

SPECIES DISCUSSIONS

The Canadian Rockies consist of a complex of ranges and massifs terminating on the east in the third prairie steppe and on the west in the Columbia and Fraser Valleys, both of which have a fairly diverse and distinctive amphibian -reptilian fauna. But in the Rockies proper the number of species is greatly restricted, containing a few boreal and a few cordilleran species. The Tailed Frog (*Ascaphus truei*) and the Painted Turtle (*Chrysemys picta*) of interior British Columbia and the prairie toads and frogs, as well as most of the snakes, are missing from the intervening Rockies. There is one species of garter snake recorded, and six species of amphibians, only three of which are at all widespread or common. But the role of these species in the Rocky Mountain environment, and many aspects of their life histories, are of considerable interest.

Tiger Salamander, *Ambystoma tigrinum*

From the evidence of local collections and from available field records, this prairie and parkland salamander apparently enters the most easterly part of the Rockies along one or two major river systems, such as the Bow and possibly the North Saskatchewan, but does not penetrate far westward. The author's own records are limited to a few observations of specimens from the Seebe, Exshaw and Bow Valley Provincial Park area. I have always found the species near shallow ponds or backwaters with mud or silt and gravel bottoms (Chilver Lake, "Middle Lake", backwaters of Bow River). My own records are from late summer or autumn, when I found salamanders (in sizes from about 7 to 17 cm long) at old Pocket Gopher or ground squirrel dens, and in vegetation from 15 m to more than 75 m from the water's edge near parkland ponds. I have no details of breeding or other aspects of life history for the region.

Long-toed Salamander, *Ambystoma macrodactylum*

The records of various collectors and naturalists, and the present author's observations, suggest that this distinctive, dark-brown to black salamander with gold-yellow dorsal stripe is both uncommon and localized in the Alberta Rockies. Yet it occurs from Waterton area north to the Jasper Park north boundary and perhaps into Kakwa, and it may be found fairly commonly in a few localities, if it is looked for actively. Sites of occurrence include Waterton Lakes region and Red Rock Creek vicinity; Crowsnest Pass; Storm Creek; Kananaskis Lakes basin; Mud and Burstall Lakes, and Spray Lake region; Banff area; Lake Louise vicinity; Leach Lake and Honeymoon Lake groups in Jasper Park (here under JNP); Valley of Five Lakes region and Edith Lake area, near Jasper; Pyramid/Patricia/Cabin Lake group; and Jasper Lake vicinity. The altitudinal limits represented are approximately 1075 m (3500 ft.; Jasper region) to above 1940 m (6300 ft.; Elk Pass, Kananaskis region). From present evidence there appears to be a "cline" southward in the occurrence of this species; the highest elevation recorded for it in the Jasper area is about 1335 m (4350 ft.) whereas in the Kananaskis region and southward the upward limit of breeding is at least 1940 m (Salt 1977).

This rather elusive salamander was found about shallow pools with considerable marginal vegetation and usually with shore cover of large boulders or deadfall;

occasionally it has been found in moss or deadfall cover at or near deeper lakes with shallows. The water temperatures under half-submerged logs in such aquatic environments are always higher than those of the surrouding waters, reaching 19° to 23°C on warm days and remaining higher by 2° to 5°C through the night. Regular temperature readings (Kananaskis; Jasper area) indicated that the fluctuation in shallow breeding waters could be as great as 12°C (from a minimum of 11°C at 6:30 to 8:30 a.m., to a maximum of over 23°C during the afternoon - Kananaskis and Jasper regions) through a twenty-four hour period, but the average fluctuations were about one-half of this figure. No breeding was noted in waters below 11°C.

Unlike some other mountain amphibians, the Long-toed Salamander is seldom discovered when it strays far from the breeding waters. Thus, records for the province tend to be an artifact of seasonal or of collecting-technique bias (it would be useless to go randomly searching for salamanders at any distance from ponds or lakes). Some adults do remain near breeding sites for much if not all of the summer. And the smaller immature salamanders appear to remain there during the entire first summer of "terrestrial" life. But my own records suggest that adults leave the aquatic margins after breeding, and then return to them in late August or September.

Information on the chronology of breeding is very incomplete. Eggs are deposited in small groups of as few as six to eight, and as many as 20 to 30, on stems of living aquatic vegetation. The earliest dates available are 14 May (Leach Lake group, JNP, 1977, elev. 1230 m) and 8 May (Leach Lake group, 1978); but the exact stage of development of these eggs was not ascertained and from subsequent observations it was determined that all were within *ca.* two weeks of hatching. An actual hatching was observed on 22 May (Leach Lake group, JNP, 1977) and on 24 June (Elk Pass, Kananaskis, 1977, elev. 1955 m). Small larvae were noted with the tadpoles of Western Toads, appendages erupted and gills visible by microscope. The latest dates available for unmetamorphosed larvae are from the Elk Pass and upper Boulton Creek sites, Kananaskis Park, where the author found large larvae still swimming in shallow puddles at a spring marsh from 1 to 5 September (1976). At this date, the tadpoles from ponds at lower elevations in the same region (*ca.* 1700 m) had apparently all completed the first stage of metamorphosis.

Because of the two larval stages in development of this amphibian it is quite usual to find both unmetamorphosed larvae, and completely transformed immatures, in and beside the same pond. The latter, transformed after hibernation in the intermediate stage, are fully metamorphosed before the spring eggs hatch. These "yearlings" resemble adults except for their smaller size. In the breeding sites known for the Alberta Rockies, the transformed young. like the adults, frequent the undersides of partly-submerged deadfall or boulders, even sheltering under the bark and mosses on logs, or work their way into deep moss and vegetation of the shores. There is little information on emergence of the fully-transformed "yearlings" in the Alberta Rockies. One or two individuals were noted emerging in early June (9 to 14 June, 1978) in Kananaskis, elevation 1707 m, and in late June (28 to 30 June, 1978) in Jasper vicinity, elevation *ca.* 1070 m.

I have found a high incidence of appendicular damage or loss in Alberta Long-toed Salamanders. Immatures in the Kananaskis region (1976-78) lacked a foot or an entire leg in roughly 38 per cent of cases examined (30 of 78 individuals). In the Jasper region from a total of about 27 records, two adults and four young exhibited such appendicular damage. The matter was not studied, but such disabilities do not appear to hamper the movement of the salamanders appreciably.

In all records available to the author of Long-toed Salamander breeding sites,

the pools were shared by at least one other species of amphibian larva. The Western Toad was present in most cases (Kananaskis, Banff, Jasper); the Spotted Frog was present in about one-half of the sites recorded (Kananaskis, Jasper); the Wood Frog was found in only one site with the salamander larvae (Kananaskis) although adult Wood Frogs have been found about the salamander breeding ponds in several cases. The rates of development of eggs and larvae differ for each species, however, and the salamander larvae were present in the ponds long after most tadpoles of Western Toad had disappeared from the waters. The rates of Spotted Frog and the salamander corresponded more closely.

No instances were noted of predation upon the Long-toed Salamander. The damage to appendages may indicate accidental injuries or deformities, or may be an effect of attempts upon the salamanders by some unknown predator(s). The matter has not yet been investigated.

Western Toad, *Bufo boreas*

This is the most widespread, and most frequently-encountered, of Alberta Rocky Mountain amphibians. Its elevational range is surprisingly great, due perhaps in part to the habit of adults of wandering long distances after mating. The toad is common in Jasper, Banff, Kananaskis and southward to Waterton at most suitable low and middle elevations. It has been encountered a great distance from water bodies, in coniferous forests, along valley trails, and even (uncommonly) on more open subalpine meadows and scree slopes. In the Kananaskis it was recorded above 2235 m, and in the Jasper region, to above 2030 m (Mt. Edith Cavell; Lookout Mountain; Beauty Creek vicinity).

The breeding sites of this toad are in most cases shallow ponds, pools, small temporary puddles, ditches with standing water, backwaters or flood-pools of streams - the vegetation often scant, or even absent, both from bottoms and from margins. The minimum water temperature recorded in the Alberta Rockies for breeding sites is 7.5°C, but most breeding locations are somewhat warmer (9°C and above). Backwaters of cold fast mountain creeks are of particular interest in this regard, for they exhibit a temperature continuum from about 3°C in the current (mid-stream) to above 15°C in the most distant and still part of the backwater. Figure 1 illustrates a typical situation in which the water-temperature gradient and the concentrations of tadpoles are charted together on a rough map of a small backwater in West Elk Pass (upper Fox Creek), Kananaskis Park (Salt 1977). Lewin and Panter also noted local breeding sites consisting of temporary puddles on old silt road-beds in this vicinity. In a few cases, the average depth of water was so limited that concentrations of tadpoles were noted only in the deeper hoof -prints of deer and Wapiti which passed through the site irregularly! In the upper Pocaterra Creek region of Kananaskis Park, the toads utilized small deeper pools created by spring melt collecting in old ungulate dust-wallows. In the Jasper region, ditch-water served a similar purpose, containing large concentrations of larvae (3-5 km south of Athabasca Lookout, elev. 1260 m; 1977, 1978).

The numbers of larvae present in even the smallest and most confined of aquatic environments may be difficult to estimate, due in part to continual movement of the tadpoles, as well as to their habit of "winnowing-in" to the soft mud bottom. However, rough estimates of populations were made in some sites by laying out visually a series of small quadrats or squares from 30 to 50 cm on each side - taking care not to disturb the waters or the bottom prior to the count - and then converting the results of several consecutive counts to a density per m^2. Densities obtained by this method average as low as 25, to averages over 500 larvae, per m^2. The range noted in the Kananaskis was understandably varied. In some confined pools in Elk Passes, elev. 1875 m, densities averaged less than 50

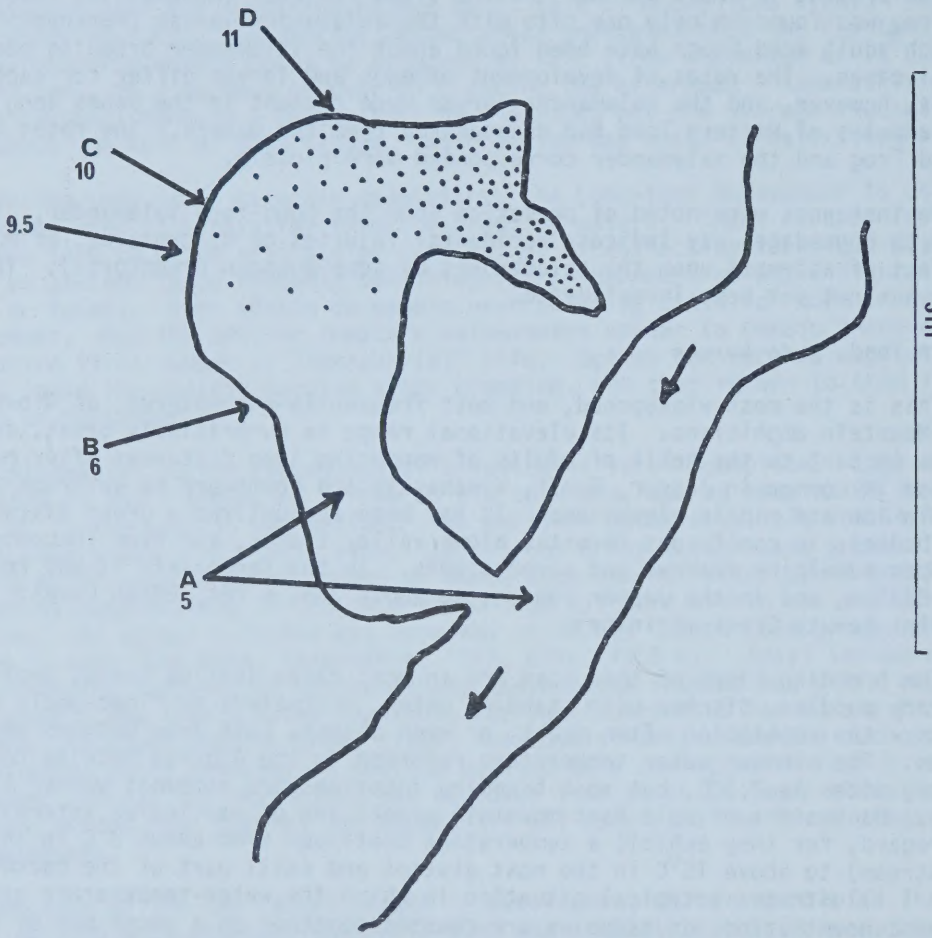

FIGURE 1. Relative densities of larvae of *Bufo boreas* in a stream backwater (Fox Creek, Elk Pass, Kananaskis Park) where water temperature is a continuum from creek temperature (points A) to pond temperature (point D and beyond).

larvae per m^2, while in pools about 1600 to 1800 m elev., many populations averaged in excess of 300 larvae per m^2. In the Jasper area (Leach, Edith Lake groups, Brule vicinity, elev. 970 to 1200 m) densities of 350 to 550 per m^2 were common. Above 1250 m, however, populations usually diminished sharply.

Mating dates vary with elevation, with latitude and with the exposure or situation of local topography. In the Brule and Jasper Lake areas (elev. 997-1000 m) a prolonged mating period was noted from about 22 April to 6 May (1976), but a major peak of activity occurred about 28 to 30 April. The event was about one week later in Jasper area (8 to 15 May, 1976) and in Kananaskis (22 May, 1978; 1570 m). In all matings observed by the author, ratios of female to male toads were slightly imbalanced; at the Brule sites this was *ca.* 1:1.3 females to males,

and in the Kananaskis the average ratio, at a number of different sites, was about 1:1.2 females to males. These ratios indicate simply that there were a few extra males in any mating pool. Short skirmishes in the shallows were common, when "spare" males attempted to dislodge and replace those already clasping females. The females - in all cases considerably larger than males - were never found unaccompanied except after completion of the mating.

Egg strings are laid or emitted continuously during copulation and consist of very long ribbons, reaching several metres in length if breeding is not interrupted. The strings float out in the water, tangling themselves in any bottom irregularity or vegetation. They are generally within 5 to 20 cm of the surface in water not deeper than 45 cm.

Female having completed mating were found to begin extended overland or aquatic voyages immediately, leaving the breeding pools. The tracks of these wandering toads, when found in dust or sand, are quite distinctive. In the Brule region, a backwater of the Athabasca River, many tracks led along the shores to the river. In other sites studied, most toads dispersed into adjacent drier marsh, meadow or forest.

Specific studies done by V. Lewin and N. Panter, as well as by the author, indicated that in the Kananaskis there was an inverse relationship between elevation and growth-rate, and between water-temperature and growth-rate of larvae. However, breeding waters at higher elevation are not necessarily colder than those at low to medium altitudes. Plate 1 shows a comparison of four different larval samples taken within a 24-hour period from breeding sites in the Elk Pass vicinity. The specimens were staged according to the method of Gosner (1960) by Panter. While the precise Gosner stages represented are not meaningful to this discussion, it will be significant to state that there is a differential of two to three weeks in the development of these larvae. Generally, the mating dates and hatching of eggs at higher elevation sites in the Kananaskis were delayed by three weeks to more than six weeks. (In some cases, eggs were evident in lower elevation ponds while snow and ice were still prevalent in the Elk Pass breeding sites.) However, in many cases the eggs and larvae at higher elevations underwent an acceleration of development or growth, induced apparently by high ambient water temperatures, so that the larvae of the shallower pools were metamorphosed within one to three weeks of those at lower elevations. At all sites studied, the larvae of the very shallow temporary puddles appeared to accelerate their development and to metamorphose before the tadpoles in deeper and larger ponds at the same elevation did so. It is useful to note in this regard that the ambient temperature of evaporating puddles increased sharply as the area and depth of water diminished, thus contributing to an acceleration of larval development. Unfortunately, I do not have sufficient experimental evidence for this phenomenon from any Alberta mountain site to chart precise developmental rates at present.

Final dates for larvae in breeding pools are of dubious significance, since there are always a few stragglers in any site. A more useful date would be that of emergence of the main population, but this event is difficult to define. Final dates (after which no larvae were noted) for some localities in Kananaskis and Jasper regions are: 18 Aug. 1976, 1978, at elevations *ca.* 1600 m (Kananaskis); 14 Sept. 1976, in deep pools, Elk Pass 1875 m (C. Tebby, pers. comm.); 30 Aug. 1976 at shallow puddles, Elk Pass, 1875 m; 19 Aug., Chilver Lake; 5 Aug., Jasper vicinity (both 1978).

There is a clear relationship between breeding Western Toads and old or abandoned Beaver works. In the Blue Lake region just east of Brule (Jasper Lake) and in the Chilver Lake and Vermilion Lakes regions, very small immature toads are

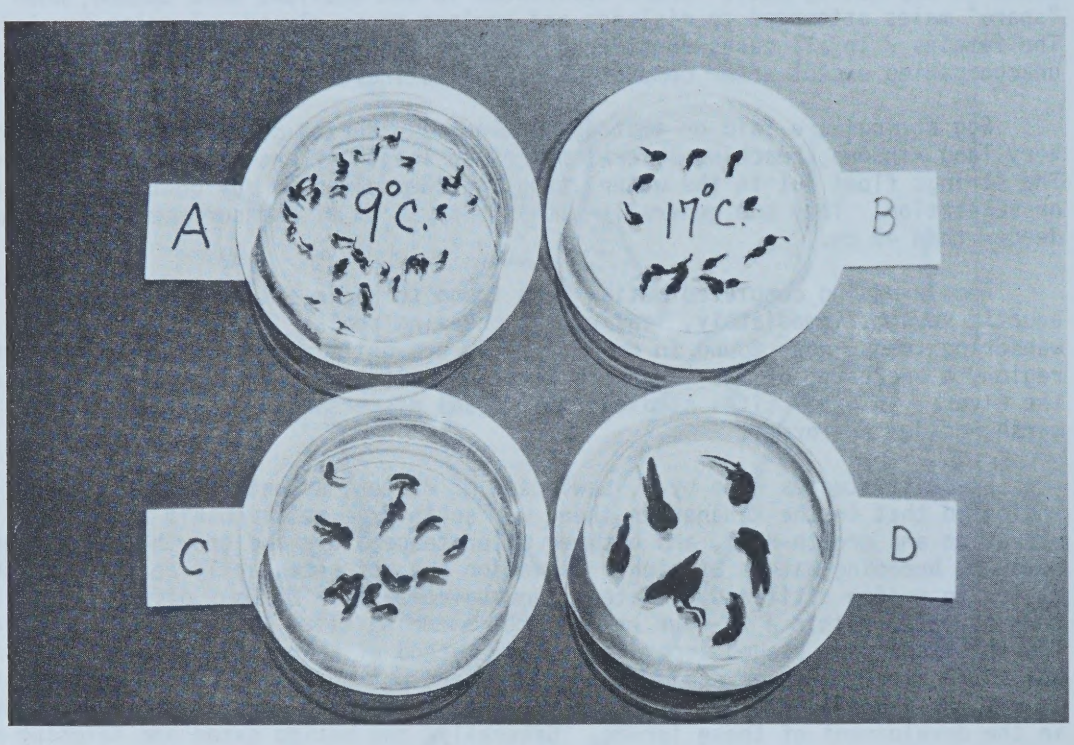

Plate 1: Progression in development of *Bufo boreas* larvae from ponds of different elevations and temperatures: A, from Elk Pass puddle, 9°C; B, from Elk Pass puddle, 17°C; C, from Elk Pass backwater, 10+°C (all at elev. 1890 m A.S.L., 15 July 1976); D, from alkaline pond, 1690 m A.S.L., 14 July 1976; water temperature 15° to 19°C.

frequently found in and around abandoned Beaver lodges or dams. In the Blue Lake area these immatures sheltered each night from about 23 to 27 May (1976), emerging in the mornings to travel in the vicinity. Each evening the numbers returning to the sites appeared to have diminished noticeably. In the Chilver Lake site larvae were noted in disused Beaver channels by an abandoned castle (22-23 June 1978; elev. 1338 m; water temperature 19.8°C to 21.5°C). On 19 August hundreds of immature toads could be noted in and about the castle, but by 23 August few were left at the site. W. Roberts notes a similar phenomenon outside the Rockies in Alberta (pers. comm.).

Information on predation is relatively abundant for this species. In the Brule region, extensive predation was noted by Common Ravens (*Corvus corax*) and Common Crows (*C. brachyrhynchos*) at or beside the breeding pools (1977). Some Ring-billed (*Larus delawarensis*) and California gulls (*L. californicus*) also visited this site, but Ravens were the principal and most active predators. In the Yamnuska Centre (Chilver Lake) area, remains of Western Toads were noted in feces of Coyote (*Canis latrans*), Short-tailed Weasel (*Mustela erminea*) and Mink (*M. vison*) (1975-78); in the Kananaskis the Coyote, Short-tailed Weasel, Mink and

Marten (*Martes americana*), Black Bear, (*Euarctes americanus*), accipiters, gulls, Ravens and Pygmy Owl (*Glaucidium gnoma*) each fed upon these toads on at least one recorded occasion. In the Canmore area there is evidence of predation by Pygmy Owl (1977). And in the Jasper area all of these predators except Pygmy Owl, as well as Magpie (*Pica pica*), Northern (*Lanius excubiter*) and Loggerhead shrikes (*L. ludovicianus*), and Red Fox (*Vulpes fulva*), were associated with the toads. Ravens were noted eating the remains of road-killed toads near Beauty Creek, JNP (1977). It is perhaps useful to note that most predators did not eat the entire toad, but left much of the skeleton, including appendages, selectively taking the muscle of the limbs, the viscera, and sometimes part of the head. The "biomass" or food content by weight of adult toads is from as little as 15 g to about 85 g, depending upon the amount eaten and the age and sex of the toad.

Wood Frog, *Rana sylvatica*

Distributed widely over the Rockies, this small frog does not, however, appear to have either the geographic or the altitudinal range of the Western Toad or the Spotted Frog in the Alberta mountains. It has been found primarily in fens, marshes or other damp valley locations, and much less frequently, at middle elevations in or near ponds and seep areas, damp meadows and stream edges. I have not found it far from water in the Alberta Rockies. Where it shares a site with the larger Spotted Frog, it is usually very much in the minority. However, as Stebbins (1966) and others have pointed out, the Wood Frog disperses widely and almost completely following breeding, making it difficult to find through the summer.

In the Rockies of Alberta this frog occurs to about 2055 m (6675 ft.) in the Crowsnest and Waterton regions; in Storm Creek and Kananaskis areas to about 1850 m (6015 ft.); and to less than 1700 m (5525 ft.) in Banff and Lake Louise areas. The highest record available from Jasper is from *ca.* 1330 m (4325 ft.). Whether these random records constitute true evidence of an elevational cline northward, or are merely the result of limited studies, is not certain at present. It should be pointed out that the diminutive size, as well as the major post-breeding dispersal of this frog, make the gathering of records erratic and difficult.

Where breeding sites of the Wood Frog are found in the Alberta Rockies, the species shares its environment with one or more of the other common amphibians, particularly with the Western Toad. Infrequently, Wood Frog larvae were noted in pools with those of Spotted Frog in the Kananaskis and Banff regions, as well as near Jasper (Edith Lake group). I have only one certain record in which Wood Frogs shared breeding pools with Long-toed Salamander. At all shared sites, the Wood Frog larvae appeared to be somewhat more fully developed than those of other species, suggesting an earlier breeding; and breeding records from the Rockies, although not numerous, do indicate that the species breeds exceptionally early. The singing of these frogs, which precedes and accompanies mating, has been heard as early as mid-April in Jasper region and the Yellowhead Pass (1965, 1974, 1976, 1978) but not until mid-May in some years (1966, 1975, 1977). In the Banff area the earliest records available to me are from 1 to 5 May (1975, 1977); at Yamnuska (Bow Valley Park) singing was noted at such varied dates as 22 April, 8 May and 17 May (1963, 1975, 1977). Even within these regions the dates of apparent emergence and of mating vary greatly, with rather small differences in elevation. In the broad open valley of the Athabasca River, Jasper area (elev. *ca.* 1000 m) singing generally occurs as much as three weeks earlier than it does at more sheltered marsh-ponds only 15 to 20 km distant, and less than 250 m higher in elevation.

Both adult and very small immature Wood Frogs are evident at breeding marshes, and a range in size from a full length of about 10 mm to over 45 mm may be noted briefly near the ponds. These immatures generally disperse shortly after the adults do, although a very few are noted throughout the summer near the mating sites.

There is relatively little information on development of larvae in the Alberta Rockies. In the Kananaskis, breeding waters with large egg masses were noted only once, from 17 to 19 June (1977; elev. 1615 m). The water temperature at this site, where eggs were found in the marginal shallows affixed to bottom vegetation, was always above 11.5°C. From fragmentary data collected by R. Clarke, V. Lewin and N. Panter, and from the author's notes, the average breeding-water temperature in the Kananaskis was from 13° to 15.5°C.

During the 1976 study for Alberta Recreation, Parks and Wildlife, larvae in early stages of development were found from 15 to 17 June at about 1615 m elev., and on 17 June at a slightly higher site (1692 m). By the method of Gosner (1960) these larvae from the lower site were at about stage 25, and those at the higher site, stage 20 to 22. However, all larvae had reached the final stage of metamorphosis (Gosner 43 to 45) by 15 to 17 July, and no larvae were noted at any site on subsequent visits (29 July through August). Emergence was noted at two low-elevation sites, and the small young frogs did not appear to remain in the wet marsh-edges for more than 3 to 6 days.

I have no evidence of predation from Rocky Mountain regions.

Spotted Frog, *Rana pretiosa* (Plate 2)

From records and specimen evidence it would appear that this large frog is widespread in the Rockies from elevations of about 995 m (Jasper area) to above 2150 m (Kananaskis, Crowsnest, Waterton areas). A general habitat preference may be described for adults; they are often found along very small brooks, rills and flowing seeps with moss or taller vascular vegetation at medium and higher elevations. At the lower elevations this rill or spring environment, and the shallow margins of ponds, sloughs or even marshes with cattail, are suitable. Through much of the summer adult frogs of this species bask on the banks, or on half-submerged rocks and logs, leaping into the water when threatened.

Like the Wood Frog and the Western Toad, Spotted Frogs become somewhat vocal during mating and for a short time before it. From descriptions of their songs given by C. Wallis (pers. comm.) from the Oldman River and southwestern regions, compared to my own descriptions from farther north, it appears that there may be geographic variants in the species; the matter requires study however.

The Spotted Frog exhibits breeding-pond preferences similar to those of the Western Toad, but water temperatures are in most cases above 13°C, and I have no records of breeding in temporary pools. In a few larger ponds (such as Leach Lake, JNP) where the average shallow-water temperature occasionally falls below 13°C, the larvae congregate beneath half-submerged logs (deadfall, etc.) or burrow into the bottom muds where temperatures remain higher; here they pass the nights and the colder days.

Eggs, similar to those of the Long-toed Salamander with large (5 to 8 mm D) outer envelope or sac, transparent and containing a large dark embryo at the centre, are affixed in groups to submerged vegetation, either at the time of mating or somewhat later as they float short distances. In all cases recorded,

Plate 2: Spotted Frog, *Rana pretiosa*, adult.

the mating or breeding waters were between 3 and 30 cm. deep.

Densities of larvae were estimated at a few sites, by the same method outlined for the Western Toad. The density of population was *ca.* 150 larvae per m^2 in Elk Passes at sites of highest population. Somewhat higher densities were noted in the Jasper Park sites near Honeymoon Lake (*ca.* 225 larvae per m^2). In the Kananaskis, breeding sites whose entire water-surface area was less than 1 m^2 held numbers of well-developed larvae from 10 or 15 to over 60.

Data on developmental rates for eggs and larvae are incomplete. The precise dates of mating in the Kananaskis (1976, 1977) were not established; however, the later development of larvae from about 15 June through 17 September appeared to parallel that of the Long-toed Salamander in the same sites. Thus, for example, both species emerged or metamorphosed from the first larval state about 24 to 30 July in sites below 1610 m elevation (1976, 1978); from 30 July to about 15 August in sites near 1775 m; and from 4 September to some date before 28 September at elevations about 1940 m (1976). In 1977, eggs of the Spotted Frog were present at the lowest Kananaskis sites (*ca.* 1575 to 1610 m) by 3 June; in the Jasper area egg masses were present before 14 May (Leach Lake vicinity, 1230 m, 1977, 1978). In 1977 eggs were more fully developed on first date of observation (3 June) than they

were on the same date in 1978; the chronological differential was about 12 to 14 days. It is possible that more data would reveal a variance in breeding dates of as much as three to four weeks at any one site from year to year.

Predation upon this species by Pygmy Owls was noted in the Kananaskis (1976) on two occasions, and in the Canmore region (1977) on one occasion. Only choice parts of the frogs were eaten. Other predators noted include Raven, Ring-billed and California Gulls, Coyote and Mink. But if the Spotted Frog plays an important role as prey to any raptor or carnivore, or to fish species, it is not evident from present information.

Leopard Frog, *Rana pipiens*

This frog has been found in the Bow Valley corridor near Bow Valley Park and Yamnuska Centre, and in the area east of Waterton. It also appears on a list of specimens taken in the Jasper vicinity, but the author has been unable to verify these specimens. The Leopard Frog must be considered hypothetical in the Alberta Rockies from present evidence.

LITERATURE CITED

Gosner, K.L. 1960. A simplified table for staging anuran embryos and larvae with notes on identification. Herpetologica 16:183-190.

Salt, Jim R. 1977. Report on the vertebrate fauna of Kananaskis Provincial Park; Vol. 2, Annotated checklists, etc. From field data collected by J. Salt, V. Lewin, R. Clarke, A. Furnell, N. Panter, *et al*. Prep'd by Peregrine Research Ltd. for Resource Assessment & Management, Alberta Recreation, Parks & Wildlife; 405 pp. & ills.

Salt, Jim R. and R. Clarke. 1979. Mammalian fauna of the Kananaskis Lakes, Upper Kananaskis River and Highwood Pass Region, Alberta. Alta. Nat. 9:22-45.

Stebbins, R.C. 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston: xiv - 279 pp.

SNOW ALGAE: A STUDY FROM HIGHWOOD PASS, ALBERTA

by Linda Olson
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Snow algae are a common feature in the high mountain and arctic areas of the world - Greenland, Iceland, Europe, Australia, Japan, North and South America and the Antarctic. They impart brilliant red, pink, orange, yellow, green, blue, purple, brown and black tones to the snow and ice they inhabit, much to the disbelief of those who have never seen them. But they are very real, although little-studied, and have dazzled alpine travellers since the 4th century B.C.

Aristotle was the first person to record their presence, but they were not mentioned again until the mid 1580's when an Englishman, John Davis, witnessed red snow in Greenland (Kol 1942). Reports of various colours then started to appear from all parts of the world. In 1818, the arctic explorer John Ross discovered it in Canada, an eighty mile stretch of red coloured snow cliffs on Baffin Island overlooking the bay. He made collections, preserved them and delivered the

specimens to biologists in England who claimed they were fungi - then plants - then animals - perhaps all three (Hardy and Curl 1972)?

Coloured snow is actually the result of microscopic algae living in the surface meltwaters, although some fungal species are present. Pigmentation of the dominant species imports colour to the snow where the algae are concentrated in sufficient numbers. Over one hundred species have been identified throughout the world, many occurring universally.

Chlamydamonas nivalis is the most prominent and abundant species of exposed snowfields at high altitudes and latitudes. Its' red pigment is a screening mechanisms for the intense blue and ultraviolet wavelengths characteristic of such areas. Other colours, particularly green, are found in more shaded localities or at lower elevations where the radiation is less intense and are not as common as the red-related shades, except in Japan where green is dominant (Hoham 1975).

LIFE CYCLE AND ECOLOGY

Cryoalgae are specialized life forms that have adapted to living in an extreme environment. They can be found in permanent or nonpermanent snow (lasting over several years or melting annually) as well as glacier ice. The life cycle usually begins in early spring when the surface snow is saturated with meltwater and nutrients blown in over the winter are concentrated by ablation. The resulting spores and akinetes (vegetative cells) of the algae arrive on the surface by two mechanisms (Hardy and Curl 1972):

1. deposition by wind, birds and animals from adjacent or distant regions; or
2. those present in the soil or deeper layers of the snowpack from previous seasons produce green motile cells that swim [or float] to the surface and grow.

In either case, they respond to the improving climate by undergoing vegetative and sexual reproduction and flourish in the surface layers where the meltwaters percolate, sometimes causing blooms. But when conditions deteriorate, they die or become dormant in a viable state until the right combination of parameters initiate their growth again (Garric 1965).

The role of snow algae in the ecosystem is not clear, but they are considered to be primary producers on the bottom of the food chain. Grazers may include iceworms and rotifer species where occurring on permanent ice (Hardy and Curl 1972), but snow bank communities and nonpermanent deposits have not been studied in detail.

ENVIRONMENTAL PARAMETERS

Initially, the chemical and physical characteristics of the meltwater alone were thought to be the controlling factors influencing growth and distribution of cryobionts (Kol 1942). This lead to numerous assumptions and classification schemes based on the surface meltwater pH as it was theorized that the mineral or nutrient source supplied from shattered rock and particles from the adjacent land (as well as windblown dust) would yield acidic or alkali conditions, and thus separate populations.

However, it is now recognized that light intensity, exposure, temperature, dissolved oxygen and depth in the snow are the key environmental parameters and causal mechanisms of algal distribution (Garric 1965; Hardy and Curl 1972).

Light. As with all plants, these organisms are autotrophic and require sunlight for photosynthesis, which would be greatest at or near the surface. The intense colour is thus brightest here as the algae are most abundant near the surface and decrease rapidly with depth. The absorption of radiation in snow is a function of water content such that as the density increases, the depth of transmission increases. Thus, the greatest penetration would occur at the height of the summer. Very low light intensities have been know to initiate germination in some plants, such that it may be likely that algal spores and overwintering stages may germinate in the soil or deep snow layers under such conditions. Exact photoperiodic requirements for snow algae have not yet been determined, but very low light values in deep snow have been shown to correlate with the date and snow depth of the first spring bloom (Curl *et al* 1972).

Temperature. Meltwater must be present for at least 24 hours to initiate germination, which implies that the air temperature must remain above freezing before vegetative or sexual reproduction will begin to occur (Stein and Amundsen 1967). Mosser *et al* (1977) analyzed a number of samples in the field and found that different populations exhibit a variation in adaptation to low temperatures - some photosynthesized optimally at $0^{o}C$ to $-3^{o}C$ while others between $10^{o}C$ to $20^{o}C$ even though they all appeared reasonably well-adapted to their environment. No correlation could be found between site location and temperature preference in regards to the elevation, aspect, exposure et cetera as the sites were in close proximity. Within one snowbank, then, there is a mixture of various strains of algae.

This heterogeneous distribution can likely be explained by considering the location and mode of "reseeding" in the snowbank/field. Spores deposited in the soil from complete melting or those transported by air currents are subjected to temperatures far in excess of $0^{o}C$. Conversely, the environment of spores in permanent snowfields or on glaciers never varies much around $0^{o}C$ (when active). Mosser *et al* (1977) proposed that these two thermal regimes could result in the selection of algal strains differentially adapted to temperature. Populations that had overwintered would possibly photosynthesize optimally at $0^{o}C$ whereas a higher and broader temperature range may suggest soil or air derived populations.

ROCKY MOUNTAIN SPECIES

In the Canadian Rocky Mountains there have been published few accounts of the species that inhabit our snowfields. Porsild and others (Kol 1964) made collections along the Eastern Front Ranges of Snow Creek Pass in Banff and Jasper National Parks, while Edworthy (1978) made a collection on the Wapta Icefield. In total, the following species have been identified:

	EDWORTHY	KOL	PORSILD
Ancylonema nordenskioldii Berggr.	X	X	
Chodatella brevispina Fritsch	X	X	X
Chlamydamonas nivalis (Bau.) Wille	X	X	X
C. ohioensis Kerr		X	
Groenlandiella nivalis Kol	X		
Raphidomena brevirostre Scherffel		X	
R. chodati Kol		X	
R. nivale Lagerh.		X	
R. nivale var. *tayleri* Kol		X	

	EDWORTHY	KOL	PORSILD
Raphidomena sabaudum f. *minus*		X	
Scotiella antarctica Fritsch	X		
S. nivalis (Chod.) Fritsch		X	X
Smithsonimonas abbotii Kol			X
Trochiscia americana Kol		X	X

Red snow is not uncommon in the Rockies and a few cases of green snow are known as well. I made a collection at a new site and keyed a number of interesting species not yet described for Alberta.

METHODOLOGY

Sampling was conducted on 30 September 1978 in a cirque valley to the east of Highwood Pass in the Kananaskis Valley between Mt. Rae and Mt. Arethusa, 50°37'N 114°59'W at an elevation of 2528.7 m (8300 ft.). Several patches of permanent snow (that perhaps had accumulated and survived the summer only for the past few years) were covered 2-4 cm deep with a fresh snowfall from the previous week. Although not obvious from the surface, a faint pinkish colour persisted under the new snow layer. From an exposed bank with a north aspect, two 113 gm samples were taken to a depth of 2-3 cm under the new snow surface and maintained at 0°C until preservation could be made. Sample A was allowed to melt overnight prior to the addition of formaldahyde at a ratio of 2/3. Sample B was kept in a cool bath until both samples had been spun in a centrifuge and decanted before the same ratio was added. Each sample was analyzed separately in the lab using a Wild -Heerbruug V (M-12) microscope with a drop of lactophenol cotton blue solution on each slide to prevent dehydration. Photographs were taken through a mount with a Fujica 605 35 mm camera on Kodachrome 135 25 ASA film.

DISCUSSION

The keying of snow algae involves an almost "picture-book" approach by matching previously described species to those under the slide. Eventually your attention is turned away from the blaze of colours to shapes - which are the most important - and then to the discrimination of true algal cells from air bubbles, rock fragments, bug parts, leaf cells, fungal spores and a seemingly infinite variety of pollen grains. The keys are often conflicting, vague and disjointed with the major work being in German; drawings and photographs are in a jumble of "grab samples" rather than a logical order such as by species or life stages for comparison. Intraspecies variation alone is quite high and is further complicated by a variety of morphologic forms as the individual goes through stages of the life cycle. Moreover, various stages between different species resemble each other so closely that even size or spine length, for instance, will not vary appreciably. It has been suggested by several researchers (e.g. Garric 1965) that the most common snow alga *Chlamydamonas nivalis* is a composite species encompassing many more cryophytes than we are able to distinguish.

With a rather conservative eye on the above considerations, the following species were observed for the study area: (*new addition)

Chlamydamonas nivalis (Bau.) Wille

Chodatella brevispina Fritsch

**Gloeocapsa sanguinea* (Harv.) Kg.

**Mycacanthococcus ovalis* Gain

Scotiella nivalis (Chodat.) Fritsch

**S. norvegica* Kol

Smithsonimonas abbotii Kol

**Tetraedron valdezi* Kol

Trochiscia americana Kol

**T. nivalis* Lagerh.

The Plate of specimen sketches (Plate 1) uses a micron scale. One micron is 0.000001 (10^{-6}) meters, or, comparing a micron to the size of a pin-head would be the same as comparing a pin-head to a 9" pizza.

A. *Chodatella brevispina*. Figure 1. Only a few *Chodatella* cells were found. They are oval to elliptical, translucent and covered with short moderately distributed spines. The name is synonomous with *Cryocistis brevispina*.

B. *Chlamydamonas nivalis*. Figures 2-6. *Chlamydamonas* is the most abundant of all the snow alga appearing in a variety of morphologic forms and brilliant colours - red, orange and yellow - which gives the snow its' characteristic colour. The pigmented cells are considered to be akinetes (Garric 1965), are spherical and fairly uniform in size but vary in the presence, absence or thickness of a protective translucent envelope. They are often surrounded by particles of dust etc. or occur in clusters that stick to the mucilagenous layer. No vegetative cells were observed, although two very short flagella -like structures were found on one specimen. Zygospores are rather rare but are unmistakable with the outer wall ornamentation.

C. *Gloeocapsa sanguinea*. Figure 7. Very few snow algae are colonial organisms - *G. sanguinea* is one such species. The specimens found consisted of a cluster of dark, red rounded cells surrounded by a lighter red stippled outer shell.

D. *Mycacanthococcus ovalis*. Figure 8. These cells are brown, small, spiny and generally oval although the width/length ratios are not consistant.

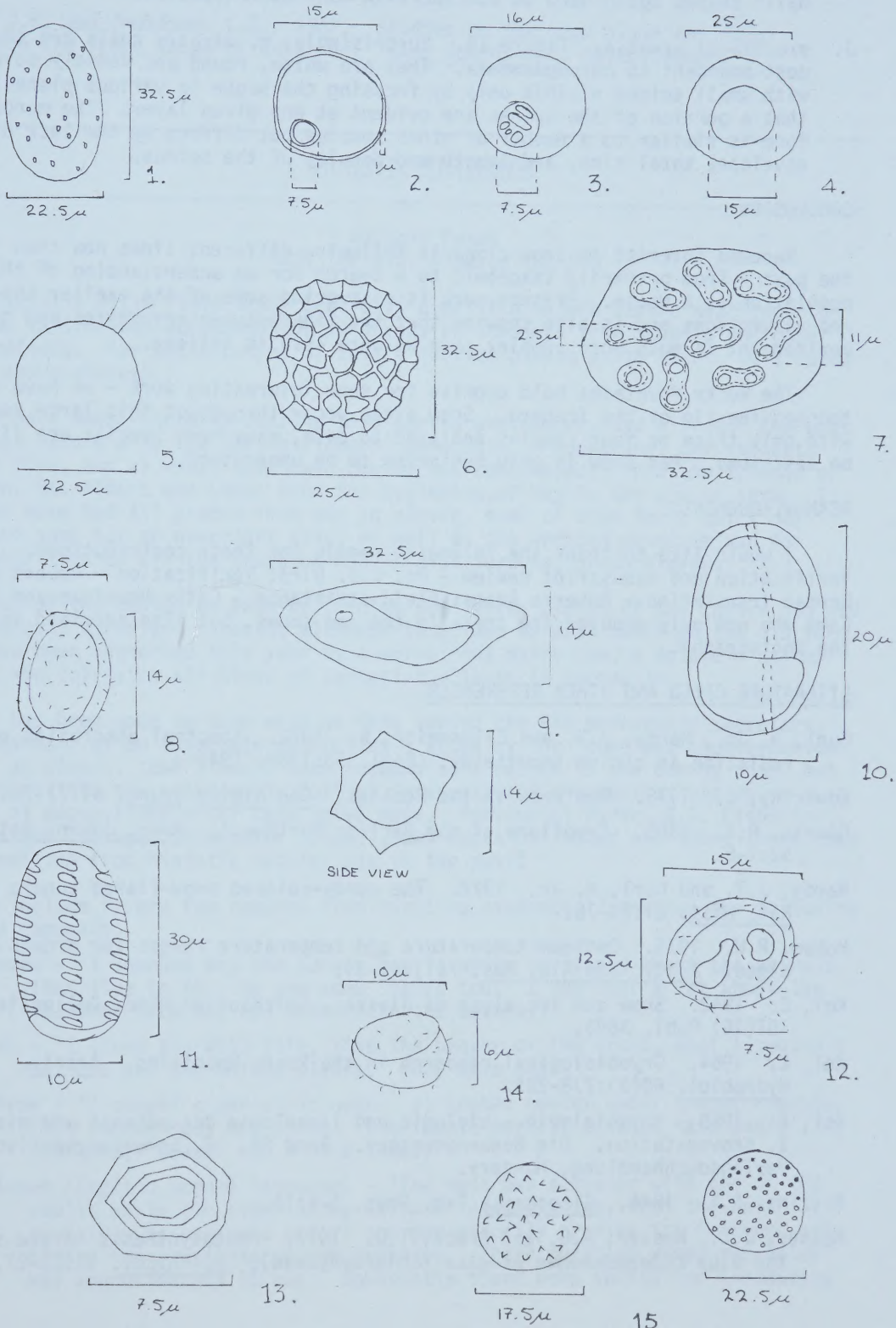
E. *Scotiella nivalis*. Figures 9-10. This particular *Scotiella* species is rather abundant in the sample. Thus, the orange and yellow pigmentation likely contributed to the overall snow colour. The cells are elliptical with several longitudinal, slightly spiral ridges running from pole to pole.

F. *Scotiella norvegica*. Figure 11. One rather unusual cell was observed that had an oval outline of twelve spiral ridges tightly wound down its' length. No interior contents were visible but a faint green tinge highlighted the spirals. This cryophyte is likely *S. norvegica* previously found only in the red snow of Scandinavia and Greenland (Kol 1968).

G. *Smithsonimonas abbotii*. Figure 12. The cells are highly variable in size and shape but display a translucent spiny envelope with green cell contents.

H. *Tetraedron valdezi*. Figure 13. Only one small polygonal cell has thus far been seen in the samples, but its' characteristic shape is easily identified. It has previously been found in the Rocky Mountains of British Columbia and Glacier National Park, Montana (Kol 1968) - both close enough to the study area for this species to be expected in the population.

Plate 1. Specimens of snow algae from Highwood Pass, Alberta. (400X)



I. *Trochiscia americana*. Figure 14. These cells appear as "deflated soccer ball" shapes again hard to confuse with many other species.

J. *Trochiscia nivalis*. Figure 15. Surprisingly, *T. nivalis* cells are the next most abundant to *Chlamydamonas*. They are white, round and densely covered with small spines visible only by focusing the scope in various planes such that a portion of the spines are evident at any given layer. The morphologic form is similar to a number of other species but differs by the lack of an envelope, total size, and length and density of the spines.

CONCLUSION

Renewed interest in snow algae is following different lines now than it has in the past - from primarily taxonomic to a search for an understanding of the population as a whole. Present work is disproving some of the earlier theories and assumptions and is also showing that the link between cryophytes and their environment is much more complex than we were lead to believe.

The Rocky Mountains hold promise for some interesting work - we have merely touched the tip of the iceberg. Snow algae occur throughout this large region and with only three or four samples analyzed to date, many more species are likely to be described. Red snow is only beginning to be understood.

ACKNOWLEDGEMENTS

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LITERATURE CITED AND OTHER REFERENCES

Curl, H. Jr., Hardy, J.T. and Ellermeier, R. 1972. Spectral absorbtion of solar radiation in alpine snowfields. Ecol. 53:1189-1194.

Edworthy, J. 1978. Red snow in the Rockies. Can Alpine Journ. 61:77-78.

Garric, R.K. 1965. Cryoflora of the Pacific Northwest. Amer. Journ. Bot. 52:1-8.

Hardy, J.T. and Curl, H. Jr. 1972. The candy-colored snow-flaked tundra biome. Nat. Hist. 81:74-78.

Hoham, R.W. 1975. Optimum temperature and temperature ranges for growth of snow algae. Arctic and Alp. Res. 7(1):13-24.

Kol, E. 1942. Snow and ice algae of Alaska. Smithsonian Misc. Collection 101(16) Publ. 3683.

Kol, E. 1964. Cryobiological research in the Rocky Mountains. Archiv. Hydrobiol. 60(3):278-285.

Kol, E. 1968. Kryobiologie - biologie und limnologie des schnees und eises. I. Krovegetation. Die Bennengewasser. Band 24. E. Schweizerbart'sche Verlagsduchhandlung, Hungary.

Kutzing, S.T. 1846. Gloeocapsa Tab. Phys. I-V:18.

Mosser, J.L., Mosser, A.G. and Brock, T.D. 1977. Photosynthesis in the snow: the alga *Chlamydamonas nivalis* (Chlorophyceae). J. Phycol. 13:22-27.

Rabenhorst, L. 1932. Kryptogamem - Flora. 14(I).

Stein, J.R. and Amundsen, L.C. 1967. Studies on the snow algae and fungi from the Front Range of Colorado. Can. Journ. Bot. 45:2033-2045.

MINISTIK MUTTERINGS

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(Ministik Hills Field Study Centre is a private nature centre near Edmonton offering tuition and accommodation to groups of students from schools and other organizations. For notification of future courses please write to Dr. Lois Fenna at the above address.)

We have been literally buzzing this spring and summer, and although the bees and wasps (along with the spring flowers) were late in appearing, the students were on time, and as usual have been coming out continuously from the schools of Edmonton, St. Albert and Leduc from the beginning of May to the end of term. I think we have had all grades from one to eleven, some of them for a quick day visit and some for an overnight stay, as well as the weekend event we run for representatives of all the Edmonton Public High Schools, grade eleven.

Most of the topics we examine involve pond life, plants of the spruce bog and aspen forest, birds and insects, although sometimes we also dwell on the old farm which has been augmented this year by a marvellous dairy cow, a Holstein called Bessie, who tolerates all kinds of tentative milkers in succession.

It has been good to have with us this spring the FAN membership secretary, Myrna Pearman, as an associate naturalist - actually the "compleat countryperson'. I wish, as always, that I could look forward to a return in the coming year, but good naturalists are notoriously full of interests and enterprise, and go on to a variety of occupations after they leave here. Provincial Parks, B.C. Fisheries, North Island College, (Vancouver Island), and Ducks Unlimited are among those that have benefited from Ministik naturalists in the past!

To include a very few remarks from visiting students, I mention the following unedited comments:

Grade seven - 'I learned why the Spruce Bog is where it is and about the animals that live in it. We saw some Cranes too. I had hear a lot about the Snowshoe Hare but had never seen one before.'

Grade six - 'I liked the Wild life, like the beaver or the frogs, what I couldn't believe was the edible plants. They were neat.'

Grade three - 'I caught a pericitic wasp. It looked neater under the microscope. This incest does not sting. The female pericitic wasps make gauls'. (No wonder Caesar had a hard time!)

Grade eleven (English second language) - 'The nest was occupied with one of the adults while the other Grebe swimmed leisurely away from the nest (possibly to create a decoy) and periodically pruning its feathers and diving for crustacearns and tadpoles. Their duration under the water was approximately 15 sec. Apparently there were shifts for incubating

the eggs. When the time came for a change, both Grebes called out, stroked beaks and the change of position takes place. The replacing Grebe then cleared the leaves, wiggles into the nest, then place the leaves strategically around itself to have more insulation. After a duration of maybe 30 minutes the Grebe cried out, shifts position and again rearrange the leaves.'

Adult courses have suffered vicissitudes this year; the bird course on the first weekend in May was subscribed fully, then almost snowed out, then almost cancelled for lack of an instructor, and went on to be most successful, due to the great spirit of the people who came and of Bruce Bembridge and Peter Demulder who stepped into the breach left by an ailing Terry Thormin. In contrast, the Wildflower Weekend had to be cancelled owing to lack of interest on the part of the Wildflowers (too early) and the Insect Weekend owing to lack of interest on the part of the public. This was a pity, because insects have such infinite variety, and I'm sure most of us would really like to know more about most of them. Hopefully the Nature Painting weekend on 11 August will be a riotous end to the season.

THREE TREE SWALLOWS

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Two is company, three is a crowd might apply to Tree Swallows too. Near the lakeshore of Pidgeon Lake in a stand of spruce and poplar trees a birdhouse has been home for Tree Swallows for 20 years. This is a lovely spot to build a nest, with undergrowth of tall lungwort, bunchberry and wild blue clematis scattered about among the shrub high dogwood.

On 8 June 1979 a pair of Tree Swallows established their territory and set up housekeeping in the birdhouse in a tree facing west. As the female gathered twigs the male sat nearby on a shrub and indicated when it was safe for her to approach. His "all clear" call was a gutteral sound of a low trill. When not gathering nesting material and during the days while laying the eggs, the female sat in the house with her head protruding enough to fill the hole.

Occasionally the male went into the house, but apparently for inspection purposes only, as he carried no nesting material. After the female started laying eggs, she guarded the nest religiously and when she wasn't there the male took his turn sitting in the house. One morning a squirrel came too near and both birds took up the attack and charged the squirrel visciously, by long flying swoops. It left in a hurry. At this point metal was put above and below the nest and on the house roof to prevent the squirrel from entering the nest and from eating the eggs or the young birds, a habit known from past years. The male swallow, except when feeding, continually sat in his blue irridescent feathers guarding while the female in her grey-black with white front tried to look unobtrusive guarding her issue.

Three days later in the early morning there was no sign of either bird. The male finally came but sat on a twig and kept calling and going to the bird house looking in the entrance. For an hour the nest was empty and there we were concerned for the eggs, as the morning was very cool with rain. Finally the

female appeared and took her place next to the male on a nearby branch. He soon approached her and mated several times; then she flew to the nest to lay another egg.

For several days there had been an extra male around causing a fuss by entering the nest. The original male always managed to chase him off but the intruder always returned the next day. But this day it had become a squabble. The extra male approached the bird house, and the female departed, leaving the stray male to take over the house, where he stayed for some time. Then the rightful male came back, went into the bird house and a fight ensued with feathers literally flying. After struggling a great deal, one male eventually came out of the house and took off over the water. During the rest of the day, the female returned for only short periods, while the males returned and fought for the rights of the bird house, and no doubt the one female. After this ruckus, we decided to check the nest to see what damage had been done. There were a lot of feathers newly settled and three small white eggs the size of a dime and still in good condition, so all that could be done was to leave the birds alone and hope their domestic quarrel could be solved, with one of the birds returning to the nest to incubate the eggs.

Who was this male intruder? A one-year-old establishing his territory? Was he the one that mated in the morning with the female? This is doubtful, as she was too submissive.

By evening this same day the intruder seemed to have given up the fight and disappeared. The female finally returned permanently to the conjugal bed, and the male had taken up his guarding again from the twig perch.

With no more serious interruptions the baby swallows eventually hatched.

RELATIVE NUMBERS OF VERTEBRATE SPECIES IN ALBERTA, CANADA, AND THE WORLD

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INTRODUCTION

In talking about the diversity of animal life in biology courses, both in schools and in universities, I find it interesting to compare numbers of species in various groups that are present in Alberta and in all of Canada with those on a world wide basis. In such comparisons, we can obtain some appreciation of the relative richness or poorness of our fauna.

I present several pie-diagrams showing the relative abundance of various groups of vertebrates (fishes, amphibians, reptiles, birds, and mammals) for class-room use and for the interest of individual naturalists. Also, in order to put the vertebrates in perspective in the world fauna, the relative size of the phylum Cordata (comprised primarily of vertebrates) is compared with all other major phyla.

Teachers may wish to make overhead transparencies or slides of the graphs for class-room use in courses dealing with our vertebrate fauna. The diagrams can also be a useful supplement to museum displays of the vertebrate fauna. The text should be read carefully before interpreting the figures. Various components may be excluded or included and users may wish to construct new graphs using a different data base in light of what is said in the Methods and Results and Discussion.

METHODS

The diagrams are based on data derived from numerous sources. Numbers of species in all groups were converted into percentages. In Figure 1, the size of the three circles is the same and is not proportional to the absolute number for the region.

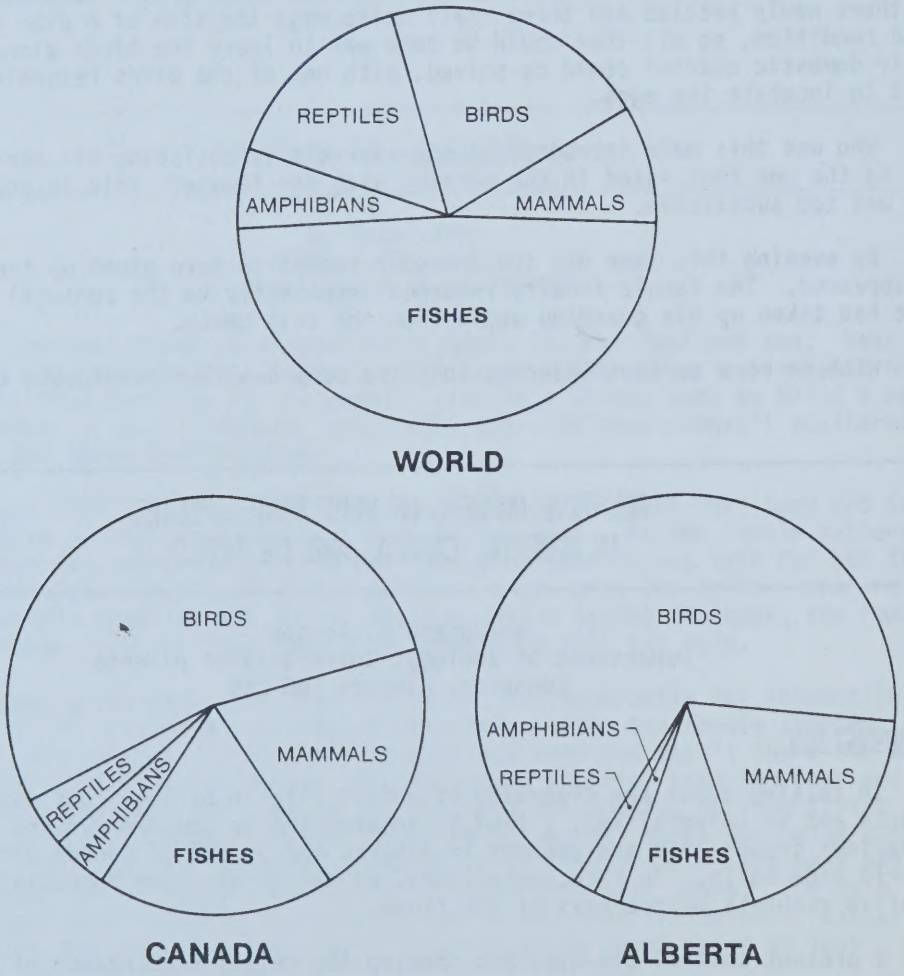

Figure 1. Relative number of species of the five class groups of vertebrates for each of the three regions (Also see Methods).

In Figure 2, the radius for each group is proportional to the estimated number of species in the world. The arc for each vertebrate category represents that portion of the world fauna for that category found in Alberta and Canada. The central angle is derived from the formula:

$$\frac{\text{number of species in Alberta or Canada}}{\text{number of species in world}} \times 360^{o}.$$

The number of species recognized in Canada is given at the end of each sector while the number estimated for the world is placed along the radius.

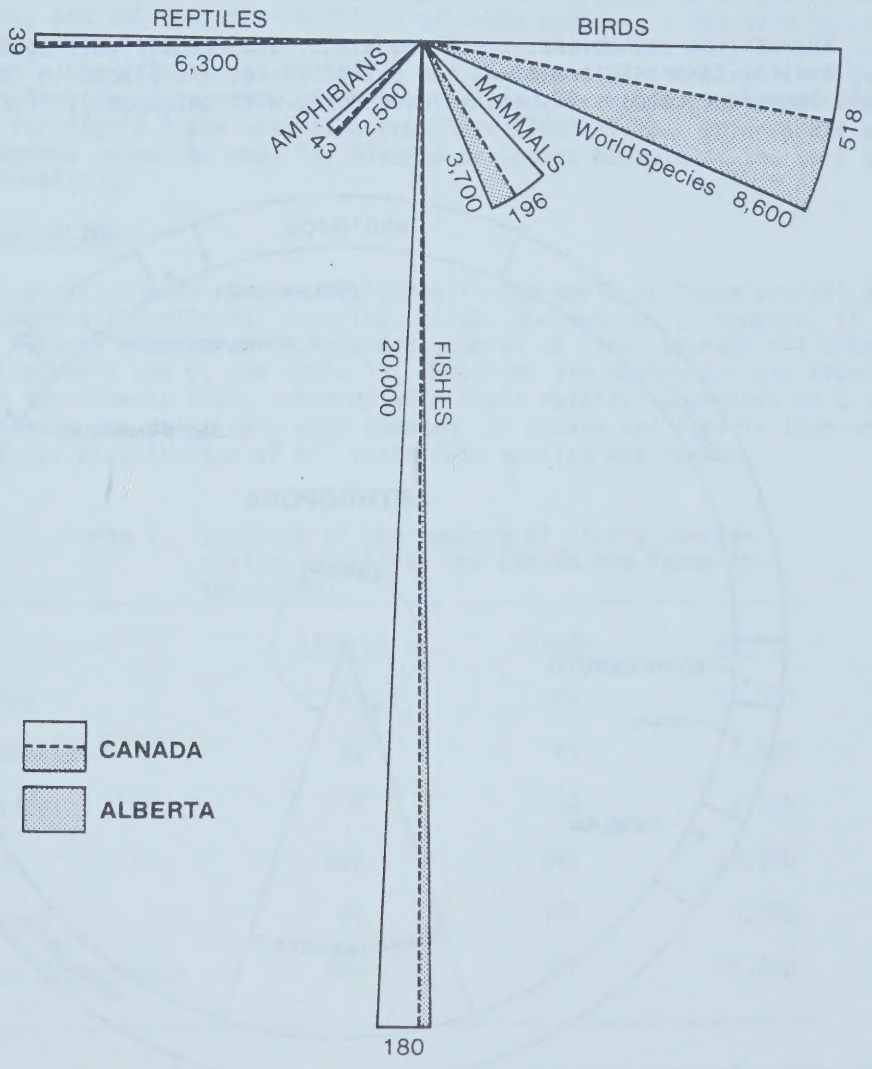

Figure 2. Relative number of species in each of the five class groups of vertebrates for Alberta, Canada, and the World (Also see Methods).

In Figure 3, the area of the outer circle represents the total number of animal species and the sections are proportional to the size of the group shown.

Data for Figures 1 and 2 are primarily derived from literature given in "Sources of Information". An attempt was made to include only native, extant species. In all groups there are taxonomic problems (should one species or two be recognized for a certain form?) and species of marginal status (perhaps known from Canada or Alberta, even the world, from only a few specimens). Changes are expected but, except for fishes on a world basis, significant changes in the graphs of Figures 1 and 2 are not expected as a result of new discoveries or interpretations.

Whereas the amphibians, reptiles, birds, and mammals each constitute a class in classical taxonomic treatment the extant fishes are placed in four classes (one might therefore compare fishes, as used here, with tetrapods). For those wishing

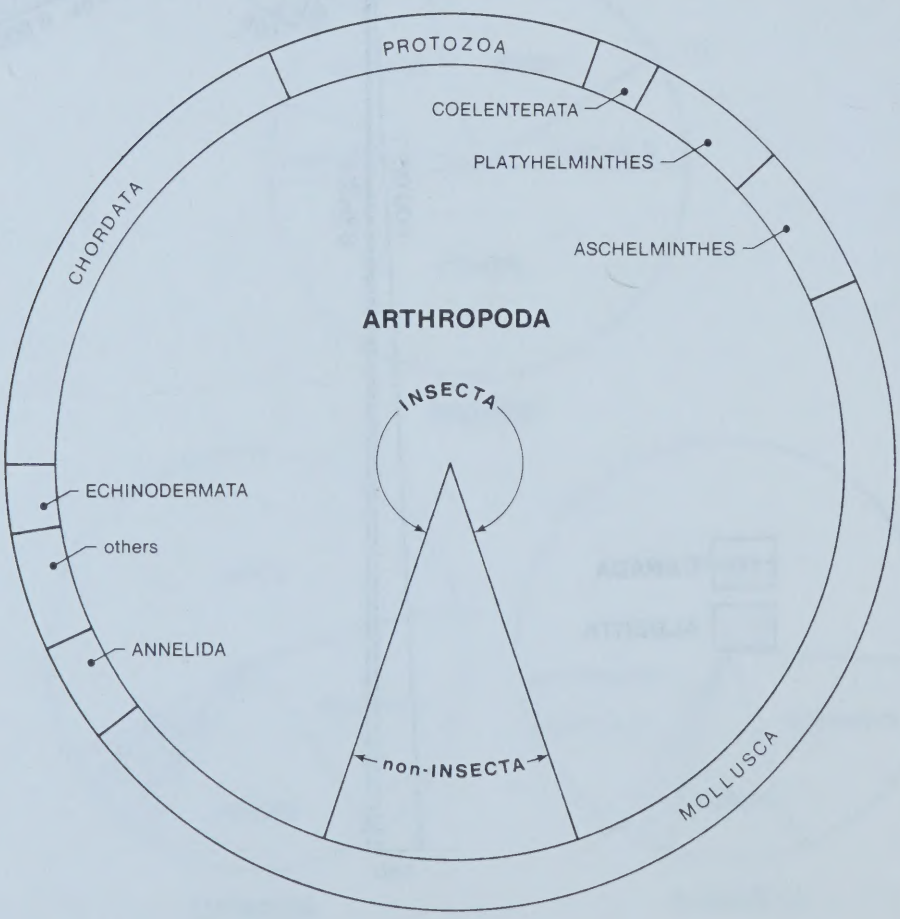

Figure 3. Relative abundance of the major groups of animals in the world.

to express taxonomic equality the graphs would be little changed. There would be the addition of three small sectors (two very small ones for the lampreys and the hagfishes and one for the sharks and their presumed relatives), since the class of bony fishes constitutes about 96% of all extant fish species.

The Alberta fish data include the discovery of four more species (published by various authors - pygmy whitefish, deepwater sculpin, mooneye, and logperch) than the figure of 45 native species recognized in Paetz and Nelson (1970). Only the number of species found for at least part of their life in Canadian freshwaters (rivers or lakes) is included in the figure of 180. If, as was done for mammals, marine species were included there would be an additional 650 or so species (in Canadian marine waters there are about 300 species known from the Atlantic, 100 from the Arctic, and 340 from the Pacific - of these numbers, a few also occur in freshwater and are thus included in the above figure of 180 and many in the Arctic Ocean are also in the Atlantic or Pacific). In the mammals, the Canadian figure of 196 species includes 33 species of whales known to occur along our coastline. The data used for Figure 3 are estimates from Mayr (1969:11-12. Unfortunately, comparable diagrams cannot be made for Alberta or Canada because of the lack of necessary information.

RESULTS AND DISCUSSION

There are about as many species of fishes in the world as there are all other vertebrates combined (amphibians, reptiles, birds, and mammals). However, in both Canada and in Alberta the number of recorded species of birds exceeds all other vertebrates (Figures 1 and 2, and Table 1). Reptiles and amphibians are especially depauperate in the Alberta fauna compared with their relative abundance on a world wide basis; mammals are relatively more abundant in Canada and Alberta than would be expected if the distribution of all vertebrate species was random.

Table 1. Estimate of the numbers of living species native to Alberta and Canada and found in the world.

	Alberta	Canada	World
Fishes	49	180	20,000
Amphibians	10	43	2,500
Reptiles	8	39	6,300
Birds	312	518	8,600
Mammals	85	196	3,700
Total Vertebrates	464	976	41,100

Because of future discoveries, it is expected that the eventual number of species of fishes recognized in the world will be very much greater than that given here. On the other hand, the numbers of birds and mammals in the world will change little while the relative proportions given for all groups for Canada and Alberta will probably remain relatively unchanged (i.e., although further discoveries are almost certainly to be made they will not likely significantly change the graphs).

In interpreting the data in Figure 1, it must be remembered that the central angles of the arcs represent proportions for that particular region - not absolute numbers. If the areas of the circles were drawn in proportion to the representative numbers then an accurate visual representation of the whole picture would be achieved (if the "world" circle had a radius of 10 cm the "Alberta" one would be a mere 1.06 cm.).

The most dramatic discrepancy between the world and the Alberta fauna is the local paucity in fishes and reptiles and the abundance of birds. However, if only resident birds were considered the difference would not be nearly as great (all of the fish and probably all amphibians and reptiles are year-round residents while most birds are not). Additionally, if only the 6,900 species of freshwater fishes found in the world were compared with freshwater or terrestrial species of the other classes in the figures the discrepancy would be even less (there are relatively few truly marine amphibians, reptiles, birds, and mammals).

The relative paucity of fishes is related to the headwater nature of our drainages and distance from glacial refugia (see Nelson, 1977, for a discussion of this subject). It is of interest to note that the state of Illinois has about the same number of extant, native freshwater fishes as all of Canada (about 180). In the Mississippi River there are about 325 species, while in the continental United States there are about 625 species of fishes. In the relatively short Fly River of Papua New Guinea (isolated on an island but, granted, one of the world's largest rivers, perhaps third or fourth in discharge) are about 100 species while the Amazon has an estimated 2000 species.

We have no endemic species (species which are confined to a given area) of vertebrates in Alberta and few in Canada (unlike such countries as Australia, New Zealand, and the United States).

The classes that we have been talking about form a small percentage of all animal species (Figure 3 - the vertebrates comprise the vast majority of the Phylum Chordata). The major phyla of animals with the number of species and percentage (in parenthesis) of the extant total number of described and recognized species are described below. Other workers may recognize markedly different numbers from these estimates, different names, and different groupings, all for a variety of different reasons. All but one are found in Alberta. At the University of Alberta we have biologists who are working on most of these groups.

Protozoa - 28,350 (2.6%). This includes the most primitive forms of living animal life. They can usually be seen only with the aid of a microscope and can be found in virtually every habitat. They include the flagellates, ameboids, ciliates, and the parasitic sporozoans.

Coelenterata - 5,300 (0.5%). These are commonest, by far, in the oceans but some freshwater forms exist (e.g., hydra in Alberta). Corals, sea anemones, and jellyfish belong to this group.

Platyhelminthes - 12,200 (1.1%). This group is comprised of the flatworms (e.g., planarians), flukes, and tapeworms.

Aschelminthes - 12,500 (1.2%). The major categories of this group are often recognized as separate phyla. They include the rotifers (usually microscopic and predominantly freshwater), horsehair worms, and nematodes (roundworms - these species, which are frequently parasitic, comprise the greatest proportion of species and some workers estimate that the total number of valid species that will eventually be recognized exceeds the number recognized to date by many times).

Mollusca - 107,250 (10.0%). This large and diverse phylum is found in a great range of habitats. Included in the phylum are: chitons, nudibranchs, squids, octopuses, clams, snails, and slugs (the last three have representatives in Alberta).

Annelida - 8,500 (0.8%). The phylum of segmented worms includes polychaetes (marine), earthworms (terrestrial and freshwater), and leeches.

Arthropoda - 838,000 (78.3%). This is by far the most diverse and extensive phylum with over three-fourths of all known recognized species of animals. This assemblage includes insects (which themselves comprise about 750,000 species or 70.0% of all animals), spiders, ticks, mites, centipedes, and crustaceans (crayfishes [one species is native in the Beaver drainage of Alberta], shrimps, crabs, copepods, etc.).

Echinodermata - 6,000 (0.6%). This is the only major phylum recognized here which lacks any representatives in Alberta (it is confined to the oceans). It includes starfishes, brittle stars, sea urchins, sand dollars, sea cucumbers, etc.

Chordata - 43,000 (4.0%). The vertebrates (with 41,700 species) make up the largest portion of chordates. The other members are marine.

Other - many other smaller phyla are recognized (some occurring in Alberta) which comprise another 9,900 species (0.9%), to make up a total of about 1,071,000 species (a conservative estimate, with most workers giving a larger figure).

ACKNOWLEDGMENTS

I thank Mrs. Gertrude Hutchinson and Miss Pauly Wong for their technical assistance in preparing the graphs. Support for this study was from the Department of Zoology, University of Alberta, and that Natural Sciences and Engineering Research Council of Canada (grant A 5457).

SOURCES OF INFORMATION

Anonymous. [Fuller, W.A., revised by N. Panter]. A key to the mammals of Alberta. Mimeo. Edmonton; Mus. Zool., Univ Alta. 19 pp.

Banfield, A.W.F. 1977. The mammals of Canada. Toronto, Univ. of Toronto Press. 438 pp.

Cook, F.R. 1970. Rare or endangered Canadian amphibians and reptiles. Can. Field-Nat. 84:9-16.

Cook, F.R. 1977. Review of the Canadian herpetological scene. pp.117-121. In T. Mosquin and C. Suchals (eds.). Canada's threatened species and habitats. Ottawa, Can. Nature Federation. 185 pp.

Godfrey, W.E. 1966. The birds of Canada. Ottawa, Natl. Mus. Bull. 201. 428 pp.

Logier, E.B.S. and G.C. Toner. 1961. Check list of the amphibians and reptiles of Canada and Alaska. Royal Ontario Mus. Contrib. 53, Life Sciences Div. 92 pp.

Mayr, E. 1969. Principles of systematic zoology. New York, McGraw-Hill. 428 pp.

Nelson, J.S. 1977. The postglacial invasion of fishes into Alberta. Alta. Nat 7:129-135.

Paetz, M.J. and J.S. Nelson. 1970. The fishes of Alberta. Edmonton, Queen's Printer. 282 pp.

Roberts, W. 1976. Key to adult amphibians and reptiles, and genera of larval amphibians of Alberta. Mimeo. Edmonton, Mus. of Zool., Univ. Alta. 2 pp.

Salt, W.R. and J.R. Salt. 1976. The birds of Alberta. Edmonton, Hurtig. 498 pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Bull. Fish. Res. Board, Canada 184. 966 pp.

Soper, J.D. 1964. The mammals of Alberta. Edmonton, Hamly Press. 410 pp.

CLUB CORNER (8)

RUNNING A NATURAL HISTORY GROUP: SOME RELEVANT PUBLICATIONS

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by David A.E. Spalding
Provincial Museum of Alberta
12845 102 Ave., Edmonton, Alberta T5N 0M6

As new natural history groups are being established and developed, and existing ones are developing increasingly complex roles in society, there is an increasing need for information on the experience of others in this area. However, relatively little has been published by naturalists for naturalists, and many of the useful publications have been written to serve a different audience, and may be hard to locate or obtain. The following list brings together those known to Natural History staff at the Provincial Museum. Many of the publications are available for reference in the Historical Resources Library, Provincial Archives. The publications and reports of other societies are also useful in giving ideas and suggestions. Staff of the Section will be pleased to offer further assistance wherever possible.

1. GENERAL

Anon. 1965. Natural Science Clubs. Can. Audubon 27(1):26-27.

Clarke, W.E. 1975. Ten steps towards an environmental club. National Wild. Fed. 10 pp.

Fishers, J. 1977. Money isn't everything. A survival manual for nonprofit organizations. Management and Fund Raising Centre, Toronto. 213 pp.

North, F.J. 1956. The local society in the community of today. Advancement of Science 1(51):163-174.

Schultz, F., and H. Schuler. 1972. Guidelines for the establishment of natural history clubs in Alberta. Alta. Nat. 2:30.

Silvestro, C.M. 1959. Organizing a local historical society. Bull. Amer. Assoc. for State and Local History 2(8):189-220.

Whitehall, W.M. 1962. Independent historical societies, an enquiry into their research and publication functions and their financial future. Boston, Anthenaeum.

2. NATURALIST

Ennion, E.A.R. 1950. The naturalist in the field today. Advancement of Science 7:285-291.

Hine, V., and L.P. Gerlach. 1970. Many concerned, few committed. A final report on the natural history survey reveals that when warmer and the under 30 group rally at the environmental barricades the generation gap disappears. Natural History 79(10):16-17, 76-80.

3. INDIVIDUAL SOCIETIES

Campbell, B. 1951. The work of the British Trust for Ornithology. Can. Field-Nat. 65:159-162.

4. FUNDING AND ASSISTANCE

Alternatives. 1974. Directory of environmental speakers and researchers. 13 pp.

Opportunities for Youth Program. n.d. A Canadian experiment. Catalogue of projects funded in 1971 under the federal government Opportunities for Youth Program of the Department of the Secretary of State. Secretary of State, Ottawa. 214 pp.

White, V.P. 1975. Grants. How to find out about them and what to do next. Plenum Press, New York and London. 354 pp.

5. PUBLICATION

Ferguson, R. 1963. Editing the small magazine. Columbia Univ. Press. 271 pp.

Hamilton, N.W. 1955. The local history magazine and its publication. Bull. of the State and Local History Soc. 2(7):169-187.

Porter, J.R. (ed.) 1964. Style manual for biological journals. Committee on Form and Style of the Conference of Biological Editors, Amer. Inst. Biol. Sciences. xiii + 92 pp.

Sirois, G.J. 1977. So you want to publish a newsletter. Gazette 10(2):18-22.

6. NATURE RESERVES

Dennis, E. (ed.) 1972. Everyman's nature reserve. Ideas for action. Newton Abbot, David & Charles. 256 pp.

Kerr, W.G. 1974. The Calgary Natural Areas study. pp. 56-62. In McKeating, G. (ed.). Nature and urban man. Can. Nature Federation, Ottawa.

Kirk, M. (comp.) 1971. Nature Reserves Manual. Federation of Ontario Naturalists, Toronto. 25 pp.

Spalding, D. 1974. Battleground for nature in Alberta's cities. pp.47-55. In McKeating, G. (ed.) Nature and urban man. Can. Nature Federation, Ottawa.

7. FIELD TRIPS

Nichol, H.F. 1967. Tips on hiking. pp 74-76. In Hayes, J. (ed.) Outdoors USA.

8. FIELD EDUCATION

Hall, E. 1974. Environmental education in the Lethbridge School System. Alta. Nat. 4:58-60.

McGaffey, P. n.d. It really works! A social action model for Local-content Environmental Education. S.T.O.P. 6 pp.

Swift, E.R. 1967. Trails that tell stories - you can build one. Pp 305-309. In Hayes, J. (ed.) Outdoors USA.

Taschereau, P.M. n.d. An introduction to nature study for summer camps. Nova Scotia Mus. of Science. 19 pp.

Vinal, W.G. (19--). Nature recreation: group guidance for the Out-of-Doors. Dover.

9. MEMBER EDUCATION

Anon. 1973. Club Corner (5): Study nights. Alta. Nat. 3:79-80.

10. LECTURE PROGRAMS

Gibbs-Smith, C.H. 1971. The arrangement and organization of lectures. Museums Assoc. Information Sheet. 4 pp.

Owen, D.E. 1956. Lectures, film shows and concerts. The Museums Association. Handbook for Museum Curators. F (3). 23 pp.

Spalding, D.A.E. 1973. Making the most of speakers. Alta. Nat. 3(2):28-30.

11. FILM PROGRAMS

Limbacher, J.L. 1967. Using films. A handbook for the program planner. Educational Film Library Assoc., New York. 130 pp.

12. WORKSHOPS

Davis, L.N. and E. McCallon. 1974. Planning, conducting, evaluating workshops. Learning Concepts. 310 pp.

National Education Association and National Park Service. 1972. A guide to planning and conducting environmental study area workshop. Natl. Education Assoc. 50 pp.

13. CONFERENCES

Edmonton Convention Bureau. n.d. Planning a convention. Edmonton. 15 pp.

14. PUBLIC RELATIONS

Block, E.S. 1951. Public relations of historical societies. 12 pp.

15. COMMUNITY EDUCATION

Anon. 1974. Mill Creek Ravine. Learning materials, process built on local resources. Environment News 3(10):1 & 5.

McNicholl, M.K. 1974. Club Corner (6): Public education. Alta. Nat. (ENHC courses and nature walks) 4:31-32.

16. ENVIRONMENTAL ACTION

Anon. 1972. What to do at a public hearing. "Defending all Outdoors". 6(2): (12).

Bell, G. de (ed.) 1970. The environmental handbook. Ballantine, New York. 367 pp.

Emond, P. 1976. Stop it! A Guide for Citizen's Action to Protect the Environment. Community Planning Association of Canada.

Parnell, M., V. Semoluk & J. Swain. 1974. Rape of the block or Everyperson's Guide to Neighbourhood Defence. Edmonton Social Planning Council. 86 pp.

NATURAL HISTORY PUBLICATIONS FROM THE ALBERTA OIL SANDS AREA

compiled by David M. Ealey

The following reports are selected from the lists of Alberta Oil Sands Environmental Research Program Research Reports. Each report is preceded by its identifying numbers. Only reports with a natural history orientation have been listed.

AOSERP RESEARCH REPORTS

AF 4.1.1 Walleye and Goldeye fisheries investigations in the Peace-Athabasca Delta - - 1975.

VE 2.2 A preliminary vegetation survey of the Alberta Oil Sands Environmental Research Program Study Area.

AF 3.1.1 A synopsis of the physical and biological limnology and fisheries programs within the Alberta Oil Sands Area.

AF 1.2.1 The impact of saline waters upon freshwater biota (A literature review and bibliography).

AF 2.2.1 Life cycles of some common aquatic insects of the Athabasca River, Alberta.

AF 2.1.1 Survey of baseline levels of contaminants in aquatic biota of the AOSERP Study Area.

AF 4.5.1 Interim report on an intensive study of the fish fauna of the Muskeg River Watershed of northeastern Alberta.

VE 2.1 Interim Report on a soils inventory in the Athabasca Oil Sands Area.

VE 2.3 Ecological habitat mapping of the AOSERP Study Area: Phase 1.

TF 1.2 Relationships between habitats, forages, and carrying capacity of Moose range in northern Alberta. Part 1: Moose preferences for habitat strata and forages.

AF 4.9.1 The effects of sedimentation on the aquatic biota.

AF 4.8.1 Fall fisheries investigations in the Athabasca and Clearwater rivers upstream of Fort McMurray: Volume 1.

VE 7.1.1 Techniques for the control of small mammal damage to plants: A review.

VE 7.1 Interim report on reclamation for afforestation by suitable native and introduced tree and shrub species.

AF 3.5.1 Acute and chronic toxicity of Vanadium to fish.

TF 1.1.4 Analysis of fur production records for registered traplines in the AOSERP Study Area, 1970-75.

TF 6.1 A socioeconomic evaluation of the recreational use of fish and wildlife resources in Alberta, with particular reference to the AOSERP Study Area. Volume 1: Summary and Conclusions.

VE 3.1 Interim Report on symptomology and threshold levels of air pollutant injury to vegetation, 1975 to 1978.

VE 3.4 Interim report on ecological benchmarking and biomonitoring for detection of air-borne pollutant effects on vegetation and soils, 1975 to 1978.

WS 1.3.3 The ecology of macrobenthic invertebrate communities in Hartley Creek, Northeastern Alberta.

WS 2.3 A preliminary study of chemical and microbial characteristics of the Athabasca River in the Athabasca Oil Sands area of northeastern Alberta.

HY 2.6 Microbial populations in the Athabasca River.

AF 3.2.1 The acute toxicity of saline groundwater and of Vanadium to fish and aquatic invertebrates.
LS 2.3.1 Ecological habitat mapping of the AOSERP Study area (Supplement): Phase 1.

AOSERP LIMITED DISTRIBUTION RESEARCH REPORTS

VE 7.2, 7.3, and 7.4 Revegetation research: 1976 Interim report.
AF 3.1.2 A synopsis of information relating to aquatic ecosystems toxicology within the Alberta Oil Sands Area.
TF 1.3 Potential productivity of Black Bear habitat of the AOSERP study area.
VE 7.1.1 Interim report on small mammal populations and related tree damage in the AOSERP Study Area, October and November 1977.
AF 4.8.1 Fall fisheries investigations in the Athabasca and Clearwater rivers upstream of Fort McMurray: Volume II.
AF 4.4.1 Preliminary recommendations for mapping of aquatic habitat parameters for the AOSERP Study Area.
TF 1.1 A census of Moose on Syncrude's Leases 17 and 22 during early February, 1977.
AF 4.9.2 Review and annotated bibliography of stream diversion and stream restoration techniques and associated effects on aquatic biota.
TF 7.2.2 The 1977 Fort McMurray AOSERP Moose Census: Analysis and interpretation of results.
TF 3.2 A preliminary review of Black Bear - human interactions and recommended strategies for the AOSERP Study Area.
TF 1.1 A Review of Moose habitat requirements.
AF 2.0 Interim report on ecological studies on the benthic invertebrates of various rivers in the Alberta Oil Sands Environmental Research Program Study Area, Northeastern Alberta.

These reports are not freely available. Limited distribution reports are available from only four libraries in Alberta - Cameron Science Library, University of Alberta; Alberta Environment Library, Oxbridge Place, Edmonton; Canadian Wildlife Science Library, 9942 - 108 St., Edmonton; and the Legislative Library, Legislative Buildings, Edmonton. The AOSERP Research Reports are found in these four libraries plus several public libraries throughout the province. Further information can be obtained from:

Publications Officer
Alberta Oil Sands Environmental Research Program
15th Floor, Oxbridge Place
9820 - 106 Street
Edmonton, Alberta T5K 2J6

RECENT PUBLICATIONS ON THE NATURAL HISTORY OF ALBERTA

Compiled by David M. Ealey and Martin K. McNicholl

Anonymous. 1979. Bird sightings. Edmonton Bird Club Newsletter April 1979:2.

Anonymous. 1979. CNF announces first nature sanctuary. Nature Canada 8(2):25.

Anonymous. 1979. Bird sightings February and March 1979. Buffalo Lake Nat. Newsletter 13:1.

Anonymous. 1979. Mammal sightings. Buffalo Lake Nat. Newsletter 13:1.

Anonymous. 1979. May 26-27 species day count. Buffalo Lake Newsletter 13:2,3-4.

Anonymous. 1979. Sunday June 10th. Buffalo Lake Nat. Newsletter 13:3.

Anonymous. 1979. Annual bus trip to Dinosaur Provincial Park via Crossfield, Drumheller, and Little Fish Lake. Calgary Field Nat. 11:37-41.

Battrum, M.W. 1979. Observations of Ladybird Beetles in the city of Calgary. Calgary Field Nat. 10:275-277.

Battrum, N.W. 1979. Natural history observations - other than birds. Calgary Field Nat. 10:278.

Battrum, M.W. 1979. Natural history observations - other than birds. Calgary Field Nat. 10:304-305.

Battrum, N.W. 1979. Natural history observations - other than birds. Calgary Field Nat. 11:19-20.

Battrum, N.W. 1979. Natural history observations - other than birds. Calgary Field Nat. 11:43-49.

Burwash, R.A. 1979. Uranium and thorium in the Precambrian basement of western Canada. II. Petrologic and tectonic controls. Can. J. Earth Sci. 16:472-483.

Butot, R. 1979. Natural history observations - birds. Calgary Field Nat. 10:279-281.

Butot, R. 1979. Natural history observation - birds. Calgary Field Nat. 10:306-309.

Butot, R. 1979. Natural history observation - birds. Calgary Field Nat. 11:21-29.

Butot, R. 1979. Natural history observation - birds. Calgary Field Nat. 11:50-58.

Christiansen, E.A. 1979. The Wisconsonian deglaciation of southern Saskatchewan and adjacent areas. Can. J. Earth Sci. 16:913-938.

Churcher, C.S., and M. Wilson. 1979. Quaternary mammals from the eastern Peace River district, Alberta. J. Paleontology 53:71-76.

Clifford, H.F., H. Hamilton, and B.A. Killins. 1979. Biology of the mayfly *Leptophlebia cupida* (Say) (Ephemeroptera: Leptoplebiidae). Can. J. Zool. 57:1026-1045.

Crack, S. 1979. Beauty and the peaks. Nature Canada 8(2):14-15.

Dusseault, M.B., and D. Scafe, 1979. Mineralogical and engineering index properties of the basal McMurray Formation clay shales. Can. Geotech. J.

Fisher, R.M. 1979. 1976 irruption of Clark's Nutcracker in Cypress Hills, Alberta. Blue Jay 37:47.

Freemark, K.F., C.R. Cooper, G.H. Finney, and A.J. Erskine. 1979. The co-operative breeding bird survey in Canada, 1978. Can. Wildl. Service Progress Notes No. 99. 21 pp.

Green, R.B. 1979. A new species of *Spiniferomonas* (Chrysophyceae) from an Alberta Lake. Can. J. Bot. 57:557-560.

Lambert, A. and P. Vanicek. 1979. Contemporary crustal movements in Canada. Can. J. Earth Sci. 16:647-668.

Lee, T.D. and G.H. LaRoi. 1979. Gradient analysis of bryophytes in Jasper National Park, Alberta. Can. J. Bot. 57:914-25.

Lein, M.R., and G.A. Webber. 1979. Habitat selection by wintering Snowy Owls (*Nyctea scandiaea*). Can. Field-Nat. 93:176-178.

Mewaldt, L.R. and J.R. King. 1978. Latitudinal variation in prenuptial molt in wintering Gambel's White-crowned Sparrows. North Amer. Bird Bander 3:138-144.

Miller, M. 1979. Re-introducing fire to Alberta parks and wilderness areas. Park News 15(1):9-13.

Monger, J.W.H. and R.A. Price. 1979. Geodynamic evolution of the Canadian Cordillera - progress and problems. Can. J. Earth Sci. 16:770-791.

Nautiyal, J.C. 1979. The place of forestry in the energy question. Can. J. Forestry Res. 9:68-75.

Picton, H.D. 1979. The application of Insular biogeographic theory to the conservation of large mammals in the northern Rocky Mountains. Biol. Conserv. 15:73-80.

Pinel, H.W. 1979. Calgary bluebird trail - 1978. Blue Jay 37:51-52.

Pinel, H.W. and J.R. Riddell. 1979. Calgary Bluebird trail. Blue Jay 37:51-52.

Roberts, W. and V. Lewin. 1979. Habitat utilization and population densities of the amphibians of northeastern Alberta. Can. Field-Nat. 93:144-154.

Schowalter, D.B. 1979. New distribution records of the Horned Lizard in Alberta. Blue Jay 37:26-27.

Smith, H.C. and D.B. Schowalter. 1979. A new subspecies of Little Brown Bat for Alberta. Blue Jay 37:58-62.

Spang, J.H., A.E. Oldershaw, and M.Z. Stout. 1979. Development of cleavage in the Banff Formation at Pigeon Mountain, Front Ranges, Canadian Rocky Mountains, Can. J. Earth Sci. 15:1108-1114.

Steeves, J. 1979. Report on Snowy Owl prowl. Calgary Field Nat. 10:267-268.

Van Zyll de Jong, C.G. 1979. Distribution and systematic relationships of Long-eared *Myotis* in western Canada. Can. J. Zool. 57:987-994.

Weeden, R.B. 1979. Relative heart size in Alaskan Tetraonidae. Auk 96:306-318. Includes previously un-published data from Gorge Creek Alberta.

Yapp, G.A. and G.C. Barrow. 1979. Zonation and carrying capacity estimates in Canadian park planning. Biol. Conserv. 15:191-206.

OVERHEARD, . . .

". . . In the woods is perpetual youth. . . In the woods, we return to reason and faith. There I feel that nothing can befall me in life--no disgrace, no calamity which nature cannot repair."

Ralph Waldo Emerson, from Common Sense No. 3

LETTER TO THE EDITORS OR TO THE FAN

Dear Sirs:

I just wanted you to know that Your Owl Contest sparked much interest in my classroom.

We became so interested that we did quite a detailed study of owls and the "Great Horned Owl". We brought in speakers from the College and a student from University. We got to see two different stuffed owls, slides, films and pictures also.

The children really enjoyed the experience and know so much about all owls.

I thought you would like to know this kind of feed back.

Very Sincerely,

Mrs. Jean Gregg
Room 20, Lakeview School
Lethbridge, Alberta

FAN AND CNF NEWS

LIFE MEMBERSHIP CATEGORY FOR F.A.N. - by Harvey Gardner and Mary Lore (Committee)

One inquiry seems to have raised the question as to whether there is a need for this category.

Continuous inflation has created problems for some associations who established a life membership fee at $25.00 and $30.00, with publications now so costly.

Recommendations: If such a category is initiated, then the monies from life memberships should be placed in a separate account to draw interest in order to meet the costs of inflation.

Unless there are more requests for this category in the next two years, at which time the need for this category could then be reviewed again as to a set fee, the committee feels there is no need for the life membership category at this time.

Are you interested in Life Memberships? If so, send your suggestions to the Committee or the Alberta Naturalist.

THIRD ANNUAL ENVIRONMENTAL EDUCATION PROJECT FOR SCHOOL CHILDREN

Sponsored by F.A.N. - POSTER PROJECT - due date May 10/79.
Committee: M.S. Lore, director, 1621 - 4 St. N.W., Calgary T2M 2Z1
assisted by Mary Bailey, Lethbridge & Maxine O'Riordan, Red Deer.

Report:

400 project announcement forms were mailed to 150 schools in all parts of Alberta.

Poster to be of an environmental theme, promoting some aspect of the environment either locally or world-wide. Eleven schools responded. On Monday, May 14/79 judges Jim Minty, Shirley Minty and Lillian Johnston evaluated the 163 posters and below are the results.

Schools

Red Deer Central - 7
Red Deer G.H. Dawe CC - 17
Cardston St. Mary's Blood Reserve - 9
Banff Elementary - 20
Canmore High - 9
Canmore Elementary - 6
Black Diamond Elem - 46
Brooks Elem - 1
Mossleigh Elem. & Jr. High - 11
Lundbreck Livingstone School - 24
Rockyford Elem - 13

Winners of Helen Schuler Memorial Category - Grades 7 - 10

1. Leah Belcourt, Gr. 8 - G.H. Dawe CC. "Pollution won't wash away" $25.
2. Lance Gariepy, Gr. 8 - G.H. Dawe CC. "Help Fight the War against Pollution" $25.
3. Burnette Driedger - G.H. Dawe CC. $25.00

H.M. - 4 receive Owl Crests

Stacy Renolds - G.H. Dawe CC Red Deer
Sandra Swanson " " "
Daryl Legen - G.H. Dawe CC Red Deer
Carol Ilchejtil - " " "

Winners of Grade III level - Wild Rose Category - $15.00 for top 3

1. Roland Haage - Black Diamond - "Protect the Horned Owl"
2. Shandel - "Save Our Gr. Horned Owl" - Black Diamond
3. Marie Wallace - Black Diamond, "Save our Gr. Horned Owl"

H.M. - Crest of Horned Owl

Layhe Wooley - Black Diamond - "Don't kill the Horned Owl Please!"

Winners of Gr. Horned Owl Category - Grades 4-6 - $20.00 top 3

1. James Ng - Black Diamond - Gr. 6 "Don't Kill Great Horned Owls"
2. Carol Pearson - Banff Elem. - "Don't spoil Nature, tidy up trash"
3. Kim Robertson - Banff Elem. - "Must You Litter!"

H.M. - 6 awards - Horned Owl crests

Gordie Weigel, Danmore Elem.
Allan Wooley, Black Diamond
Ronnie Dumonceau, Lundbreck
Tyler Dunbrack - Black Diamond
Wade Purcha, Lundbreck
Margaret McKay, Banff Elem.

Received on 15 May/79 - 3 Lethbridge Elem.
45 - Grande Prairie Elem. - 10 H.M.'s given

Cheques will be mailed to the students at their schools by 1 June/79.

Thank you for your entries. M. Lore

REPORT ON CANADIAN NATURE FEDERATION CONFERENCE, ANNUAL GENERAL MEETING AND EXECUTIVE MEETINGS by M.S. Lore, former Vice-President, CNF

President now is: Diane Griffin, Edmonton, Alberta

Vice President for Alberta, B.C. and Yukon is
Eric Tull, Edmonton, Alberta

Vice President for Sask., Manitoba and N.W.T. is
Sheila Anderson, Winnipeg, Manitoba

The 1980 CNF Conference will be at Univ. of Man., Winnipeg - August 25-31, 1980.

FAN and clubs will host the 1982 CNF conference.

The many field trips were tremendous! Early morning birding was great too! Over 260 attended. The site was Macdonald College in new and old buildings, a nice place for the conference - entertainment, banquet and a slide presentation gave pleasant variety, as well.

The winner of the Douglas Pimlott award for Conservation was Dr. Jennifer Shay from Winnipeg, Manitoba, professor at Univ. of Manitoba. She was there to receive her award. There were six other nominees. Particulars of the work she has done to deserve such a nice award (eskimo carving of a walrus - large size) and a certificate describing the award) will be in the next issue of Nature Canada.

The present administration continues to manage efficiently and effectively, and the financial picture is good, with a plus balance and our membership at 19,920. More memberships and response to the financial appeals would be of assistance to CNF.

Report: Extensive guidelines for directors duties; planning a conference; protection of natural areas - were accepted. Environmental Action Committee; By-laws committee are still in planning stages. Environmental Education camp at Ministik for teenagers with potential environmental leadership has been delayed for lack of a sponsor to supply the $20,000 necessary for same. We will try one more year. Essays had come in response to the Cougar Poster, which had been sent to all high schools in Canada.

A Logo was chosen, which can be used on brochures and on the magazine - the head of a Muskox.

Nature Canada continues to be received well with bookshop sales best at Christmas. The Nature Canada calendar will be out soon for 1980. M. Lore will have a supply; please order early.

The Environmental Action Program by Richard Pratt, Environmental Specialist is most gratifying.

Government reports and reports from CNF, Canadian Wildlife Federation and World Wildlife Fund (Canada) have contributed to an Official Endangered Wildlife list which has 16 species on it, and will be available soon to the public free of charge.

Briefs urge zero takes of marine wildlife as the present government method is not based on ecological relationships, and more efficient surveys of populations

must be undertaken. Much of Pratt's report dealt with National Parks policy input; acidic precipitation in the Atikokan area of Ontario; pesticides in sprays which affect farms, forests, people and wildlife; concern about the north and protection being withdrawn from the Polar Bear Pass area to permit discussion of its future while companies looking for minerals and petroleum could be laying claims. This results in concern over foraging areas for Caribou and Muskoxen.

Resolutions presented concerned:

1. Urge federal government to withdraw Lancaster Sound from new development for a period of 5 years to assist the biological productivity and diversity of the area.
2. That CNF urge governments at all levels to accept more responsibility for the quality of the air - Canada and U.S. plants, etc., spraying, etc.
3. Protection of lands and wildlife and people's rights in the northern areas of our country.
4. Dempster Highway and wildlife concerns.
5. Sidney Island, B.C. - that CNF urge B.C. province to acquire the lands to make Sidney Island a complete provincial park.

Detailed resolutions will be published in Nature Canada.

We had good weather and lectures regarding Quebec and their environmental issues were very good. Interpretive services were available for both English and French languages.

Do plan to go to Manitoba in 1980 if at all possible.

Eric Tull is now your Vice President, so let him know your society's concerns and I am sure he will keep you informed as I have tried to do, so that we understand the Canadian Nature Federation's goals a little better. Thank you.

PRESIDENT'S PAGE

Let me say a few words in praise of F.A.N.'s field trips. Those of us who have been wise enough and fortunate enough to participate in F.A.N.'s field trips over the years have enjoyed a remarkable opportunity to experience the natural diversity of our province. We have visited new areas in the company of people who share our interests and enthusiasms and we have been guided by people knowledgeable about, and proud of, the part of the province in which they live. These field meetings have been a rich, exciting and fun part of our heritage as an organization.

Memories are abundant. Early plants of the Milk River and the Drumheller Badlands and the Calgary foothills; yellow ladyslippers in the Yamnuska; the birds of Beaverhills Lake; the Red Deer River before the dam decision; Camp Caroline in winter; The Kananaskis in summer; Larch Valley in the fall; the eastern warblers and Barred Owls and sedge fens and spruce bogs of Cold Lake; the antelope south of Lethbridge; the Cypress Hills; and the Oldman River as it should always be.

Of course there was more. And there will be more; Stettler and the parkland in the fall; perhaps Grande Prairie and Trumpeter Swans in the spring. We will continue to explore our land and expand our horizons as naturalists. As social events, F.A.N.'s field trips are merely seasonal highlights, but as events of interest to the student of natural history, you cannot afford to miss them!

Mike McIvor, President

EDITOR'S PAGE

Once again I find myself with the pleasurable, though not enviable, task of editing the Alberta Naturalist - once again following Virginia Lang. An editor's job is always approached with mixed feelings - we must try to encourage all potential contributors, yet wield the red pen necessary to maintain quality of writing throughout. Achieving this balance without causing offence is a pleasant challenge, not always without frustration.

Each time a new editor takes over, some changes are inevitable. My first innovation is to add the journal name, volume and year to the top of each page as an aid to bibliographers - this at the suggestion of Bruce J. Milner, who has contributed both the cover and two articles to this issue.

I hope authors will look at any major editing of their articles as an educational experience. Environmental education is emphasized in this issue, with the resurrection of an old feature: teacher's corner, as the lead article. We hope teacher's will contribute articles to this column, so that we may present a feature in each issue. Joe Nelson's article also has suggestions for teachers, and we continue to present a junior naturalists' section as part of an overall educational program. Dave Spalding's resurrection of "Club Corner" also features environmental education.

In addition to teacher's corner, we would like to encourage readers to contribute regularly to our news sections - "Notes and News" and "Conservation News" - all contributors will be indicated - those with initials only refer to one of the editors. Letters to the editors are always welcome too.

Finally, please feel free to offer any suggestions for improvement of your magazine - we always appreciate ideas.

A special thanks is due to Virginia Lang, our previous editor, for her fine work, and for much of the early editing of this issue. Dave Ealey smoothed over the transition and Mary Lore helped transfer much of the material to Calgary. Evangeline Case is responsible for the final typing. Floyd Wylie helped with much of the preliminary typing - primarily on Doug Whitfield's typewriter while we visited Edmonton on a July weekend. Bruce Milner took time out from changing jobs and moving to Vancouver to contribute the cover and lead article - to all these people I wish to offer a special thanks in producing this issue.

I look forward to all your contributions!

Martin K. McNicholl, Editor

CLUB NEWS

Bow Valley Naturalists

A series of hikes throughout the summer replaces the more formal evening programs of fall and winter for B.V.N. The executive have been busy as usual with national park issues. B.V.N. has participated in the Lake Louise Visitor Services Centre planning process and in the public hearings before the Environmental Assessment Review Panel to consider the proposal by Public Works Canada to twin the first thirteen kilometers of the Trans-Canada Highway in Banff National Park from the east gate. In addition, several members attended a very useful and interesting meeting with Parks Canada officials to discuss issues raised in this year's "State of the Park" brief. A litter clean-up at the Vermillion Lakes revealed that the growing concern for a clean environment has not yet reached everyone.

- Mike McIvor

Edmonton Bird Club

The Edmonton Bird Club plans an interesting and varied program of fall meetings and field trips.

Meetings take place in room 245, Agriculture Building, Univ. of Alberta, at 8:15 p.m.

Fall program meetings:

Sept. 21 - Member's night. Everyone brings a few of their best slides.

Oct. 19 - T.V. Narayana will talk about Birds of Nepal.

Nov. 16 - Richard Fyfe will talk about Peregrine Falcon research both at Wainwright breeding facilities and in the field.

Field trips: leave from the Safeway parking lot at 82nd Ave. and 109th Street, at 10:00.

Sept. 9 - Beaverhill Lake.

Sept. 30 - Destination to be announced.

- David M. Ealey

Lethbridge Naturalists' Society

Our society's spring highlight was the pleasure of hosting our Federation on the May long weekend - our fourth time to entertain F.A.N. in southern Alberta, but the first time in our home town. We enjoyed having our F.A.N. friends from throughout the province to our society's home at the Lethbridge Community College, where we moved during the past winter to accommodate our increased membership.

At Saturday night's meeting, attended by over 100, members enjoyed the lecture and slides by Morley Barrett on the "Ecology of Pronghorn Antelope in Southern Alberta".

A Sunday tour, appreciated by 90 members, enabled flower and bird watchers alike to see southern Alberta's many species. On the Milk River Ridge, in the

heart of Pronghorn Country, we were able to see about 20 antelope.

Monday morning surprised our organisers. About 40 people toured north to Keho Lake where flowers and birds were identified in perfect weather.

Early morning birders enjoyed seeing our wide variety of good habitat within the Lethbridge area. Part of our bluebird trail, which is very productive, was visited by Calgary and Edmonton bluebird enthusiasts on the Sunday evening.

Lethbridge enjoyed being host to F.A.N. members. WELCOME BACK.

The Lethbridge Naturalist Society again took part in the Alberta Bird Species Census. A total of 137 species was counted during the two day count of 26-27th May. 87 observers counted 16,689 birds between 03:15 am to 09:00 pm. Teams of 2-4 observers drove by car 391 miles, walked 54 miles, and one hardy couple drove 5 miles by team and wagon. Weather conditions were very favourable. Locations surveyed within our 50 mile radius were river valleys, coulees, range land, dry land, irrigated land, prairie lakes, marsh sloughs and city and rural parks. Outside our 50 mile radius 15 people sent in impressive lists from Waterton National Park, Bow Island, and Onefour. Mammals were counted and a wide variety of flowers were recorded.

Michael O'Shea in the March, 1979, Naturalist gave a report on the occurrence of Blue Jays in Lethbridge. This spring he located a nest high in a spruce tree in the center of town where young were raised. This gives credence to his assumption that Blue Jays have been breeding in Lethbridge.

Birds have emergencies too. An American Robin having a too leisurely spring bath had an urgent call, and laid her egg in the bath water.

A cacophony from Starlings broke the early morning spring air. Their actions were as vigorous as their sounds. Upon investigating the result was one dead baby American Robin.

- Hazel Ross

Trumpeter Swan Naturalists

The T.S.N.'s held their May meeting in the Wembley School as usual. We agreed to try to convince the County of Grande Prairie to discontinue their present policy of spraying the roadside bush with 2,4-D and 2,4,5-T. Since that time, we have written letters to all our County council members as well as the Environment Minister, J. Cookson, and our own M.L.A. We have received a letter from the council stating that they had representatives of the Dept. of Agriculture Weed Control and Field Services Branch assure them that nothing was ever proven against the chemicals that the County is presently using. We have not given up trying to change their minds, but their spraying operations are presently in progress.

Our summer meetings have been moved to the Lake Saskatoon Provincial Park. We have had coffee and a weiner roast after our meetings at the park. Gordon Holton, of the University of Calgary, reported to us that only 88 Trumpeter Swans were here on 22 May this year as compared to 145 last. Of these, only 16 have nests as compared to 22 last year. Bad wintering conditions in the United States, and a late spring here are possible factors in this decline.

- Ellen Craig

NOTES AND NEWS

Catharine Whyte - We learn from the March/April 1979 issue of the Newsletter of the Calgary/Banff Chapter of the National and Provincial Parks Association of Canada, that Catharine Whyte, a Banff artist, passed away on 7 March 1979. Mrs. Whyte was well known for her support of conservation organizations, especially N.P.P.A.C., as well as native and historical endeavors. She had an honourary doctorate from Univ. Calgary, was honorary chief of the Stony tribe, and had received a number of other awards for her woork. Alberta naturalists are among many who have lost a good friend. - MKM

LORAN L. GOULDEN MEMORIAL AWARD

Nominations are welcome at any time for the Loran L. Goulden Memorial Award for outstanding work on any aspect of natural history in Alberta. Nominees need not reside in Alberta, but the work recognized must have been conducted in the province, or the province included in studies encompassing broader areas. To be considered for the fifth award (to be awarded in January 1980), nominations must reach the committee by December 1979. Unsuccessful nominations and nominations received later than 1 December will be considered for subsequent awards. Efforts by amateurs and by professionals encouraging amateurs will receive particular favour by the committee, but nominations need not be restricted to these. Nominations should be sent to:

Dr. Martin K. McNicholl
c/o Federation of Alberta Naturalists
Box 1472
Edmonton, Alberta T5J 2N5 Canada

WINNIPEG NATURALIST RECEIVES NATIONAL CONSERVATION AWARD

Jennifer Shay, a botany and landscape architecture professor at the University of Manitoba in Winnipeg, was recently named the first recipient of the Douglas H. Pimlott Conservation Award. The award was created in 1978 by the Canadian Nature Federation, following the death of Douglas Pimlott, a noted wildlife biologist and conservationist, to honour outstanding contributions to Canadian conservation, characterized by the tackling and completion of difficult conservation tasks of national significance.

In announcing the award at the annual conference of the Canadian Nature Federation, the organization's president, Martin Edwards, noted some of Dr. Shay's achievements in environmental protection. As co-chairperson for the International Biological Programme in Manitoba she convinced the provincial government to establish ecological reserves. Four areas have been created at Reindeer Island, Wampum Red Pine, Brokenhead River and Red Lake. Through Dr. Shay's efforts, one of the last remaining areas of tall grass prairie in Canada is preserved. The Winnipeg parks system protects the St. James Prairie and provides interpretive facilities and programs for visitors.

Dr. Shay has worked with citizen conservation groups in Manitoba for many years. She is past president of the Manitoba Naturalists Society and co-founder of the Junior Naturalists. Her involvement with the Society resulted in the establishment of Spruce Woods Provincial Park and the protection of plant and animal communities in Turtle Mountain Provincial Park where they were previously

being replaced by exotic timber plantations.

As founder and current director of the Delta Marsh Field Station, Dr. Shay has increased the level of provincial environmental education. Since its establishment in 1967, some 25 graduate science degrees have been earned through work at the field station. The station not only offers research opportunities for university students but it also offers courses for high school students and adults.

Dr. Shay is also currently a member of the National Committee for Ecological Reserves, a board member of the Manitoba Museum of Man and Nature, and president of the Canadian Botanical Association.

Douglas Pimlott was well-known for his work to protect wolves. His concern for wilderness preservation and his dedicated drive spearheaded the formation of both the Canadian Nature Federation and the Canadian Arctic Resources Committee. For 16 years he was professor of animal ecology at the University of Toronto Department of Zoology.

- CNF press release

Editors's Note: Dr. Shay had a major influence on the development of my own involvement in naturalist organizations. We worked together on the board of the old Natural History Soc. of Manitoba, worked on certain environmental issues together, she taught me a botany course at university, and was director of the field station at Delta while I was a graduate student there. Thus, I am especially pleased by CNF's selection of her as the first Pimlott awardee. - MKM

ALBERTA SOCIETY OF PROFESSIONAL BIOLOGISTS

The Alberta Society of Professional Biologists is pleased to announce a symposium entitled "Environmental Management Strategies--Past, Present, and Future" to be held on 22 and 23 April, 1980, at the Edmonton Plaza Hotel in Edmonton, Alberta.

Eminent speakers from university, private industry, and government from across Canada will be asked to explore environmental management strategies as they relate to biological issues in Alberta and North America. All registrants to the Symposium will receive a copy of the published Proceedings.

For further information about this symposium or about the Alberta Society of Professional Biologists, write to:

The Secretary
Alberta Society of Professional Biologists
Box 2824, Postal Station A
Edmonton, Alberta
T5J 2G5

- Don Thompson

BIRDSCOPE

BirdScope, the newsletter for everyone interested in birds, is now going to press with its fifth edition. In this short time BirdScope has demonstrated an ability to publish news about birds more rapidly than any other universal publication in its field, with stories such as the Vardaman project and the Newcastle Disease outbreak in the U.S. It takes no more than 30 days to get a BirdScope news item into print. Many newsletters of purely local interest do as well, but none on the international scene. Look at the publication dates on your

incoming mail.

BirdScope is the only monthly birding publication dedicated to covering the international news of birds.

Most bird enthusiasts can afford to subscribe to only a few publications. Through its own resources, supplemented by the Wilson Society Library at the University of Michigan, BirdScope reviews and abstracts items of interest from dozens of publications around the world. There are hundreds of such sources available and BirdScope's coverage is constantly expanding.

Regular features unique to BirdScope are current reports of rare bird sightings, a calendar of ornithological events and announcements of new and forthcoming bird books.

BirdScope has been requested by a number of prestigious organizations including the American Birding Association, the Cornell Laboratory of Ornithology, the U S National Park Service Library, the Osterreichische Gesellschaft fur Vogelkunde, the Minnesota Ornithological Society and the Wilson Ornithological Society. These subscribers convince us that what BirdScope is doing is both interesting and important. BirdScope would be pleased to offer an exchange subscription for the Alberta Naturalist as well.

We welcome the use of BirdScope as a medium of information exchange. BirdScope would be pleased to publish announcements of rare birds in the Alberta area, interesting projects of the Alberta Naturalists or any other avian event. As a newsletter, BirdScope is particularly interested in recent or forthcoming events. BirdScope is also prepared to pursue stories of particular interest to its readers on request.

In order to build BirdScope's circulation, we are offering a special subscription rate of $9 Canadian to the members of the Federation of Alberta Naturalists. (Published rates are $12 U.S. and $15 (US) for foreign subscriptions.) This special rate is offered if the subscriptions are entered at one time by the F.A.N. and covered by a single payment. There is no deadline. The F.A.N. may quote whatever subscription rate you care to for your membership and use this offer as a fund raiser, if you wish.

- Thomas F. Conroy
Editor and Publisher

Editor's Note: This offer will be discussed at the September FAN meeting, and an announcement made in the December A.N. concerning who to contact within FAN regarding subscriptions - printing of this advertisement free for one time does not constitute endorsement by FAN or the editors.

GOVERNMENT CONTACTS

The recent federal and provincial government elections have provided Alberta naturalists - both concerned and curious - with a slate of names to learn.

Those ministers and government departments which deal with environmentally -oriented matters have changed considerably in the Alberta government. Unfortunately, changes are still going on within the civil service, so only the senior positions in departmental organizations can be mentioned here.

Contacts:

Alberta Energy and Natural Resources
Minister: Merv Leitch 427-3740
407 Legislative Building, Edmonton

Assoc. Minister for Public Lands and Wildlife: Bud Miller 427-3674
4th Flr. North Tower
9945 - 108 St., Edmonton

Deputy Minister, Energy Resources: G.B. Mellon 427-7727

Deputy Minister, Renewable Resources: F.W. McDougell 427-3552

Assistant Deputy Minister (A.D.M.),
Alberta Forest Services: J.A. Brennan 427-3542

A.D.M., Public Lands: C.E. Paquin 427-3498

A.D.M., Fish and Wildlife: G.R. Kerr 427-6749

Alberta Environment

Minister: Jack Cookson 427-3672
222 Legislative Bldg., Edmonton

Deputy Minister: W. Salodzuk

A.D.M., Environmental Protection Services: E.E. Kupchanko

A.D.M., Environmental Engineering Services: P.G. Melnychuk

A.D.M., Environmental Co-ordination Services: H.W. Thiessen

Director, Alberta Environmental Centre: R.S. Weaver

Alberta Recreation and Parks

Minister: Peter Trynchy 427-3672
107 Legislative Bldg., Edmonton

Deputy Minister: T.A. Drinkwater

A.D.M., Parks: J.E. Potton

Federal environmental departments are apparently unlikely to remain under current ministers because of the numerous dual portfolios. Information on changes in the supporting civil service for these departments will be sought after a "settling-in" period. The federal, environmentally-oriented ministers are:

Fisheries and Oceans

Minister: James McGrath

Indian Affairs and Northern Development

Minister: Jake Epp

Environment

Minister: John Fraser (also postmaster-general)

Energy, Mines and Resources

Minister: Ray Hnatyshyn

Science and Technology

Minister: Ray Hnatyshyn

As these federal and provincial bureaucracies should stabilize over the next few months, additional information will be published later in order to help naturalists understand the organization of government departments which are responsible for environmental matters.

- D.M.E.

CONSERVATION NEWS AND COMMENT

The future of National Parks in Canada - An excellent summary of the problems faced by National Parks in Canada, together with an approach to solving these problems is contained in a paper by W.A. Fuller, "Tragedy in our National Parks?" The paper is the first in a distinguished lecture series sponsored jointly by Parks Canada and the National & Provincial Parks Association of Canada. It can be obtained for $1.00 from the latter organization at #308-47 Colborne St., Toronto, Ontario M5E 1E3. - MKM

Large Numbers Projected for Peregrine Release - A news report from William Burnham, Western Manager of the Peregrine Fund notes plans to release no less than 60 to 70 Peregrines into 6 or 7 western states in 1979. Even if half this goal is realized, it is indicative of phenomenal success in the captive-breeding program, especially when one then adds the eastern program plus Canadian programs. Two Peregrines fostered in Peregrine nests and bred in captivity have returned to breed in Alberta. - MKM

Fire in Park Management - In a recent issue of Park News, 15(1), 1979, Melanie Miller points out that fire suppression practices of the past have often resulted in ecological damage to areas naturally adapted to periodic fire, often resulting in more severe burns than would have occured had earlier fires not been suppressed. Ms. Miller outlines a proposed policy on fire in parks, based on natural cycles of occurrence, natural and human resources in the area, etc., in which carefully controlled fire could be used to maintain park values. Cypress Hills and Kananaskis Parks are specifically mentioned. Full citation of the report is given in the literature section of this issue of A.N. - MKM

ALERT and Odyssey - ALERT is a new environmental organization: the Alberta League for Environmentally Responsible Tourism, founded in Rocky Mountain House on 5 April 1979. The aim of ALERT is to act as a watchdog organization to ensure that exploitation is replaced by the wise and thoughtful use of our wilderness resources.

One of the group's first concerns is the Odyssey, 200 acre, 20 million dollar,

500 unit convention centre proposed for the north end of Kootenay Plains. This unique and fragile ecological region is an historically famous plain, some parts of which are semi-desert. Currently the plains are vastly overused by unrestrained campers, semi-permanent squatters and trail bike and all-terrain vehicle users. The construction of a huge recreation complex (Odessey) along the lower Cline River could add enormously to existing problems.

Numerous unanswered questions concerning the impact of Odessey on the Kootenay Plains remain and the government has decreed that no more studies will be done. ALERT had recommended that the proposed Odessey development be re-located to "a less vulnerable site" east of Nordegg where the rainfall is sufficient to maintain and restore vegetation after disturbance.

ALERT is a responsible environmental action group that deserves the support of Alberta naturalists. - Fred Schutz.

Trans-Canada Highway Twinning - Banff National Park - The latter part of June this year saw six days of public hearings - three in Calgary and three in Banff - before the Environmental Assessment Review Panel, to consider the proposal by Public Works Canada to twin the Trans-Canada Highway in Banff National Park from the East Gate to Kilometer 13. Both F.A.N. and the Bow Valley Naturalists presented briefs at the hearings in which they contended that alternatives to twinning had not been investigated adequately and that potential impacts on the park's natural resources would be more severe than the proposal indicated. The Panel expects to make their report to the Minister of the Environment, and the public, this fall. - Mike McIvor

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REQUEST FOR INFORMATION

F.A.N. is planning to publish province-wide bluebird trail results, starting with the 1978 and 1979 results in the 1980 supplemental edition. To accomplish this, get your 1978 and 1979 summaries in to Cam Finlay, Site 9, R.R.2, Sherwood Park, T8A 3K2 or send them to your local coordinator. (You can, of course, still publish results in more detail in your club bulletin.)

Club Bluebird Trail Coordinators are:

Stettler - Lloyd Lohr 742-3846
Lethbridge - Duncan McIntosh 327-5466
Calgary - Don Stiles 271-4689
Edmonton - Cam Finlay 467-7649

If you have any questions about setting up a bluebird trail, see your local coordinator, or get in touch with Cam Finlay. A sample form follows this request.

- Don Stiles

BLUEBIRD TRAIL RECORD SHEET

SECTION_____ DISTANCE TO NEXT HOUSE_____

HOUSE NO._____ POST___ TREE___ T/POLE___ ROAD SIDE___

HOLE FACING_____ HABITAT_____

SIGHTINGS ONLY_____ DATE_____

_____ DATE_____

OCCUPANT SPECIES_____ LONG/LAT._____

DATE										
NEST UNDER CONST.										
NEST MATERIAL										
EGGS										
YOUNG										
YOUNG BANDED										
STERILE EGG										
CLEAN OUT										
REPAIR										
REPLACE										
REMOVE										
VANDALISM										

BAND NO. _____

_____

REMARKS _____

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JUNIOR NATURALISTS' SECTION

A WEST COAST INDIAN LEGEND (About the Douglas Fir)

A long time ago -

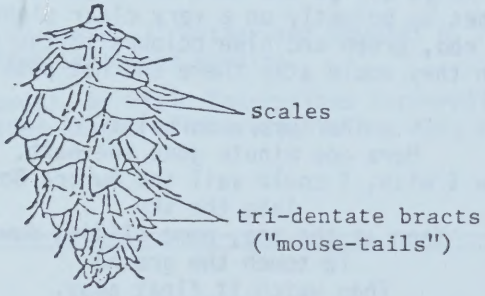
the Great Spirit was sitting on a hill, his back propped against one of the very large trees that grow in British Columbia (and some places in Alberta). He was thinking; thinking about the whole world! But the little mice kept bothering him. They ran all over him - over his feet, through his hair. The Great Spirit had asked the mice to leave him alone. Finally, he lost his patience and warned the mice that he would give them to the count of three to get away or else!

"One . . . . . two . . . . . three."

The mice were very frightened at this and immediately disappeared. The Great Spirit was surprised at how quickly the mice had moved and looked around to see where they had gone. He looked all around, and then up in the tree. There were many cones on the tree. It was the Douglas Fir Tree - and there in the cones were the little mice hiding, their heads tucked deep into the cones.

See if you can find two hind feet and their tails sticking out of a Douglas Fir cone.

Ever since, you can always know the Douglas Fir tree by the mouse tails in its cones!



- Joy Finlay

THE AURORA BOREALIS

by Catherine Brady, Grade 6

In this essay I will explain where the Aurora Borealis is found, what it is and whether there is another name for it. I shall also describe what it looks like.

The Aurora Borealis is usually found in the northern skies. It is also found in the southern skies but is called Aurora Australis there. The Aurora Borealis is best seen in Alaska, Canada (near Hudson Bay), southern Greenland and Norway.

Sometimes it is seen as far south as the United States and is also seen at the latitutude of sixty degrees.

On many clear nights you may see the Aurora Borealis. In some places where the Aurora Borealis is seen the most brightly, you can see a faint arc in the sky. When the Aurora Borealis is seen, the most brilliant lights are fifty to a hundred miles high and are usually coloured green, red and blue. The Aurora Borealis is most frequently and most brilliantly seen when a large group of sunspots are visible on the sun.

Most astronomers think that the Aurora Borealis is formed when electrically charged particles from the sun's radiation collide with particles of the earth's magnetic field and make brilliant red, green and blue rays in the sky. Astronomers also think that the Aurora Borealis is caused by electrical storms. The particles of the sun's radiation collide with the particles of the earth's magnetic field.

The Aurora Borealis got its name from the green goddess Aurora. The Aurora Borealis is quite often seen in autumn and early spring, it is not often seen in winter.

I have seen the Aurora Borealis many times. The most beautiful way to explain the Aurora Borealis is in a poem. In the poem I shall now write I shall explain my feelings about the Aurora Borealis.

THE AURORA BOREALIS

The Aurora Borealis
Also called the Northern Lights,
Shines so brightly on a very clear night.
With red, green and blue colours in the sky.
I wish they would stay there and not pass me by.

The Aurora Borealis
Here one minute gone the next.
How I wish, I could sail the Aurora Borealis
Into the sky
Then at the top, come sliding down
To touch the ground
Then watch it float away.

THE GREAT PLAINS WOLF

by Lynn Hamn, Grade 9

The Great Plains Wolf, often called the buffalo wolf, once preyed on the great herds of bison that roamed the prairies. As the plains were settled, and the bison was slaughtered, the wolf began to attack livestock. Bounties encouraged hunting, trapping, and poisoning of the buffalo wolf and by the 1930's it was extinct.

The wolf fears and avoids man. It sometimes raids domestic livestock but most often hunts moose, deer, caribou and mountain sheep. It especially hunts animals that are weak, sick or old. It also eats small mammals, birds, fishes, berries and insects. Wolves generally hunt and forage in packs.

The wolf often mates for life. Inbreeding can diminish the health of the

pack and possibly results in abnormalities. Two months after mating the female wolf bears from four to six pups. April or May are the months in which the pups are usually born. They do not begin to see until they are about a week old. After weaning at about nine weeks the pups are taken to a rendezvous site where they are left alone for the first time until early November when they are to get their first lesson on how to hunt. If a mother is killed when she returns to the hunt after weaning, an aunt takes over her role. All pack members take turns in protecting and educating the pups of the pack.

A large Great Plains Wolf male was six feet long from nose to tailtip, three feet high at the shoulder and weighed ninety-five to one hundred pounds. Females were smaller and weighed eighty to eighty-five pounds. A female wolf matures in two years and a male in three years.

This wolf originally was seen over almost a quarter of the continental land mass of North America. It was the first of the wolves to come into direct competition with settlers, and as a result they received the brunt of man's efforts at extermination.

The wolves of the Great Plains followed, and lived on the great herds of buffalo, probably ranging in their migrations from the Prairie Provinces of Canada to the shortgrass prairies of Kansas and northern Texas. The last of the buffalo wolves were exterminated by the early part of the century. The size of the wolf also provoked the people to exterminate them.

The future of other wolves and wild animals is in our hands; they can and will survive if men learn to understand and hence to appreciate and value them.

REFERENCES

The World of the Wolf, by Russel J. Rutter and Douglas H. Pimlott, Copyright 1967, Printed in the United States of America.

The World Book Encyclopedia, by Field Enterprises Corporation, Copyright, 1974, Printed in the United States of America, Volume #21, W-Z.

OVERHEARD. . .

"To speak truly, few adult persons can see nature. Most persons do not see the sun. At least they have a very superficial seeing. The sun illuminates only the eye of the man, but shines into the eyes and the heart of the child. The lover of nature is he whose inward and outward senses are still truly adjusted to each other; who has retained the spirit of infancy even into the era of manhood. His intercourse with heaven and earth becomes part of his daily food."

Ralph Waldo Emerson, from
Common Sense Number 3

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Rocky Mountain YMCA

ENVIRONMENTAL EDUCATION PROGRAMS

Introduction to Nature Photography

This workshop will give the participant a brief but broad introduction to camera techniques: choice and use of lenses, measuring of light and selection of exposures for different subject and conditions, commonly used films, small or compact artificial light equipment such as electronic flash and peripheral aids. Subjects will include flora, fauna and landscapes. Problems of finding, approaching and photographing live subjects will be dealt with.

E12	Sept 14 to Sept 16	$45
E13	Nov 2 to Nov 4	$45

Mountaineering Photography

Practice and direct experience with the special problems of photography while climbing or ski-mountaineering is the emphasis of this program. This is an introductory course including camera, basic, lenses, and other equipment best suited to mountaineering photograpyy and methods for acquiring pictures under difficult physical and photographic conditions.

E15	Sept 20 to Sept 23	$45

Intermediate/Advanced Nature Photography

A general workshop directed at wildlife or biological photographers with some camera experience. Macro techniques, advanced wildlife techniques and some biological considerations, intermediate lighting techniques and associated skills, are stressed. Large format photography is discussed (4 x 5).

E8	Oct 26 to Oct 28	$45

Autumn Fauna Workshop

This weekend is planned to coincide with or concentrate upon the phenomena of pre-winter: migration, hibernation, and dispersal of the young. Floral life will also be examined to determine the adaptation of plants to winter, to ensure continuation of the species in the spring.

E17	Oct 19 to Oct 21	$45

Winter Environment and Ecology of Flora/Fauna

This workshop includes an introduction to the special problems which plants and animals face in the Alberta mountain winter, and the many varied ways in which life forms react to and solve the difficulties of sub-freezing weather, snow, long nights and short days.

E4	Dec 7 to Dec 9	$45

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